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Publications of the

BRITISH FIRE PREVENTION COMMITTEE.—No. 78.

Edited by Edwin O. Sachs

FIRE TESTS WITH FLOORS

A FLOOR

OF

HOLLOW CONCRETE BEAMS RE-ENFORCED WITH IRON RODS

BY

MESSRS. VISINTINI & WEINGÄRTNER,

ZÜRICH, SWITZERLAND.

The Committee's Report.

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LONDON, 1903.

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48. FIRE TESTS WITH FLOORS. A Floor of Deal Joists and Coke-Breeze Concrete.

[*Continued on page 24.*

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OBJECTS OF THE COMMITTEE:

The main objects of the Committee are :—

To direct attention to the urgent need for increased protection of life and property from fire by the adoption of preventive measures.

To use its influence in every direction towards minimising the possibilities and dangers of fire.

To bring together those scientifically interested in the subject of Fire Prevention.

To arrange periodical meetings for the discussion of practical questions bearing on the same.

To establish a reading-room, library and collections for purposes of research, and for supplying recent and authentic information on the subject of Fire Prevention.

To publish from time to time papers specially prepared for the Committee, together with records, extracts, and translations.

To undertake such independent investigations and tests of materials, methods and appliances as may be considered advisable.

The Committee's Reports on Tests with Materials, Methods of Construction, or Appliances are intended solely to state bare facts and occurrences, with tables, diagrams, or illustrations, and they are on no account to be read as expressions of opinion, criticisms, or comparisons.

NOTE.

THIS Report deals with a floor of hollow concrete beams re-enforced with iron rods, and laid side by side.

It is of somewhat unusual construction, and demonstrates a principle which in concrete floors might be followed up and developed with advantage.

The Testors desire me to state that this test is not a final one, as they have some doubts as to the composition of the concrete, in which, at a future test, they hope to effect an improvement.

ELLIS MARSLAND.

LONDON,

September 18th, 1903.

THE GENERAL ARRANGEMENTS FOR TESTS.

(MEMORANDUM.)

THE purpose of the tests undertaken by the British Fire Prevention Committee is to obtain reliable data as to the exact fire-resistance of the various materials, systems of construction, or appliances used in building practice.

The tests are of an entirely independent character, arranged on scientific lines, but with full consideration for the practical purpose in view. Absolute reliability is assured, records being mostly taken automatically, or by photography, and the temperatures being easily regulated by the application of gas.

All reports on tests solely state the bare facts and occurrences, with tables, diagrams, and illustrations, and on no account are reports to be taken as including expressions of opinion, nor should any expression be read as a comparison or criticism.

The general arrangement and direction of the tests are in the hands of the Executive, who act in accordance with certain principles laid down after careful study and experiment. The official tests are attended by the members of the Council and the members of the Committee in rotation.

As to the Committee's present Testing Station, it comprises a house, standing in its own grounds, near Royal Oak Station, and backing on to the Great Western Railway. The principal building is used for Committee Rooms and laboratory purposes, whilst the gardens are utilised for so-called "full-size" tests.

As to the financial aspect of the station, the establishment expenses are being met by a special subscription. As far as the funds of the committee permit, investigations and experimental tests with ordinary (*i.e.*, not patented) forms of construction are undertaken from time to time and duly reported on. Official tests with patented materials, makers' systems, etc., etc., are subject to a scale of charges, but these charges are so figured as to only just cover the actual cost. The Testing Station is also open to members for such private research work or tests they may desire to undertake.

The services of the members participating in the management of the station, conducting or attending tests, are given entirely gratuitously.

For the Executive,

EDWIN O. SACHS, *Chairman.*

OFFICIAL REPORT

OF THE

British Fire Prevention Committee.

[FOUNDED 1897—INCORPORATED 1899.]

FIRE TEST No. 48, AUGUST 12, 1903.

A Floor of Hollow Concrete Beams re-enforced with Iron Rods.

BY

MESSRS. VISINTINI & WEINGÄRTNER.

ZURICH, SWITZERLAND.

OBJECT OF TEST.

To record the effect of a fire of two hours' duration, gradually increasing to a temperature not exceeding 2,000° Fahr. (*1093·3 C.*), followed at the end of the two hours by the application of a stream of water for two minutes, and the consequent rapid cooling.

Note.—The area of the floor under investigation to be 100 feet (*9·29 sq. m.*) superficial in the clear (10 ft. by 10 ft.) (*3·048 × 3·048 m.*).

The load to be carried by the floor was 224 lbs. per foot super (*100 kilos.*).

SUMMARY OF EFFECT.

After 65 minutes the floor began to sag and continued to sag.

After 106 minutes about $\frac{1}{3}$ of the floor collapsed with a portion of the load.

The remaining portion of the floor remained in position, and was sagged in the centre about $5\frac{1}{2}$ inches (*·139 m.*).

On the application of water the soffit of the beams where struck by the water was to some extent washed away.

DESCRIPTION OF TESTING PLANT.

(*See Figs.* 1 *to* 4.)

The testing chamber was located at the Committee's Testing Station, and was known as "No. 1 Hut."

The chamber was constructed, as shown, of stock bricks with lime mortar, and measured 10 ft. by 10 ft. (*3·048 × 3·048 m.*) internally.

The ceiling of the floor tested was 8 ft. 6 in. (*2·59 m.*) above the pavement of the chamber.

The hut was covered in every night with tarpaulins.

The openings were bricked up on the morning of the test.

The fuel used was gas produced at the station, and the supply was regulated by valves and dampers.

The gas was admitted through two mixing chambers of fire-brick, each 10 ft. by 3 ft. (*3·048 × 0·914 m.*) as shown.

Two Roberts-Austen pyrometers were used for recording temperatures, the first to take a continuous record

from point No. 5, and the second to take four observation records from points 1, 2, 3, 4.

There were three observation holes, one in the north wall, and one in the south wall, and one in the west wall.

The draught holes were in the north and south walls.

The photographs were taken by daylight.

The stream of water was applied through a branch with ½-inch (*·0127 m.*) nozzle, and supplied from a small steam fire pump.

CONSTRUCTION OF THE FLOOR.

(*See Figs.* 1, 2, 3, 4, *and* 5.)

Plans, elevations, and sections of the floor are shown.

The beams were cast at the Testing Station 57 days before the test. They measured 10 ft. 8½ ins. (*3·263 m.*) in length, 8 ins. (*·203 m.*) in width, and 10 ins. (*·254 m.*) in depth.

On June 12th, 13th, 15th, 16th, and 17th, the beams were cast on their sides in a mould of 3 in. (*·076 m.*) deal, loosely framed together in the form of a box open at the top and bottom. Inside the box were arranged tapered triangular blocks of iron, having a handle for easy removal. These blocks were spaced 1½ in. (*·038 m.*) apart, 1½ in. (*·038 m.*) from the sides of the box, and about 6 in. (*·152 m.*) clear of the ends. Two rows of $\frac{5}{16}$ in. (*·0079 m.*) diameter iron rod were placed in the top and bottom of the mould—that in the top being $\frac{3}{16}$ in. (*·004 m.*) in diameter, and that in the bottom $\frac{5}{16}$ in. (*·007 m.*) in diameter—and connected by $\frac{3}{16}$ in. (*·004 m.*) diameter iron rods, fixed diagonally, with hooked ends, to the top and bottom rods. Concrete composed of Portland cement and sand in the proportions of three

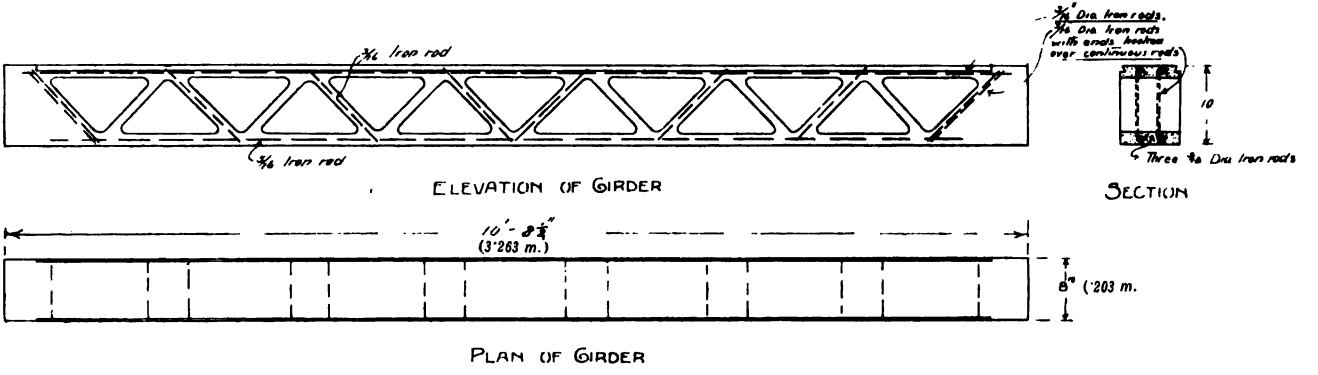


Fig. 5. DETAIL SHOWING CONSTRUCTION OF CONCRETE BEAMS.

parts of sand to one part of cement was rammed in the mould around these blocks and embedding the rods. The cement was allowed three hours to set, when the blocks were removed, and the mould taken to pieces.

On July 16th, 17th, and 18th, the beams were laid close together across the hut. Fifteen beams were used.

On July 20th and 21st the joints on the surface were filled in with cement and sand in equal proportions.

On July 22nd the joints on the under surface of floor were filled in with cement and sand in equal proportions.

On July 23rd the whole of the upper surface was coated with cement and sand in the proportions of 3 of sand to 1 of cement. The layer was about $\frac{1}{4}$ in. (*·0063 m.*) thick.

The floor was loaded with bricks equal to 224 lbs. per foot super (*100 kilos.*).

THE TEST.

(*See Figs.* 6, 7, *and* 8.)

On August 12th the test was undertaken. The following is a log of the test :

At 4 p.m. the floor was intact.

At 3 p.m. the meteorological observations taken at the Botanical Gardens, Regent's Park, read as follows :

State of weather, cloudy ; Wind, W.N.W. ; Barometer, 29·88 in. (*·759 m.*) ; Attached Thermometer, 64° (*17·7* C.) Fahr. ; Dry Bulb, 70° Fahr. (*21·1* C.) ; Wet Bulb, 59° (*15·0* C.) Fahr. ; Light varying breezes ; Fine afternoon.

The table given on next page shows the temperatures taken from the four pyrometer observation points in the hut, as shown on the drawings, Nos. 1, 2, 3, 4.

Fig. 6. VIEW SHOWING TOP OF FLOOR DURING TEST.

	Minutes Elapsed.
At 3·30 p.m. the gas was lighted.	0
At 4.0 p.m. smoke coming through the joint between edge of flooring and parapet wall of hut, generally all round and also from under centre stack of bricks.	30
At 4.30 p.m. the joints of the underside of the flooring were open about ¼-in. (*·006 m.*).	60
No further change could be observed to the underside of the floor during the test, and at 5.30 the underside of floor and the sides and soffit of joists were incandescent, but there was very little flaking off.	120
At 5.30 p.m. the gas was shut off.	120

At 5.30 p.m. water was applied through a ½-in. (*·012 m.*) branch at 40 lbs. (*18·14 kilos.*) pressure to the underside of the flooring until the fire was extinguished.

OBSERVATIONS AFTER TEST.

After Load had been Removed.

(*See Figs.* 7 *and* 8.)

The joists measured 9½ by 9½ in. (*·2413 × ·2413 m.*) at the charred surface, and were charred to a depth of ¾ of an inch (*·019 m.*). The unburnt timber measured 8 in. (*·203 m.*) on the soffit. The flooring was burnt half way through, leaving no rebate, and daylight was visible through the joints. The boards appeared to have shrunk, and the space between them in the centre of the bearing was ⅜ths to ½ in. (*·009* to *·012 m.*), tapering to nothing over the joists.

The top surface of the floor was not charred, but the fire had come through the flooring along a joint at the N.W. corner, and there were five other small holes over the surface of the floor in the line of joints.

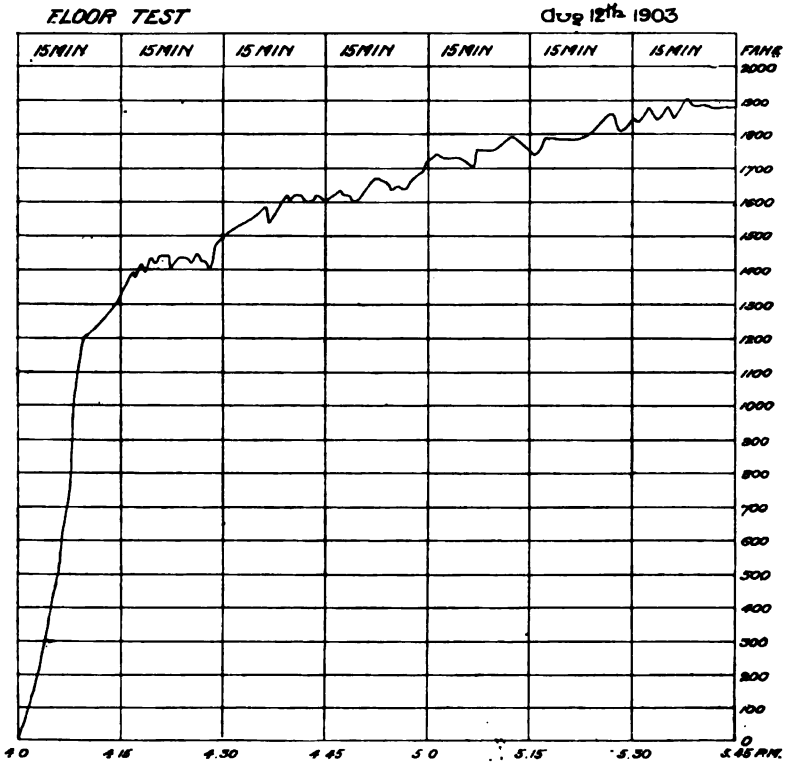
Fig. 8. VIEW SHOWING TOP OF FLOOR DURING TEST AND AFTER THE COLLAPSE OF THE EASTERN PORTION.

Observations taken at Points Nos. 1, 2, 3, 4.

From 4 p.m. to 5.45 p.m.

Time.	No. 1.	No. 2.	No. 3.	No. 4.	Minutes Elapsed.
P.M.	Deg. Fahr.	Deg. Fahr.	Deg. Fahr.	Deg. Fahr.	
4.5	1130	1010	990	1090	5
	(*610*)	(*543·3*)	(*532·2*)	(*587·7*)	
4.10	1350	1230	1170	1300	10
4.15	1420	1290	1260	1420	15
4.20	1470	1380	1360	1470	20
	(*798·8*)	(*748·8*)	(*737·7*)	(*798·8*)	
4.25	1530	1430	1410	1530	25
4.30	1570	1500	1470	1600	30
4.35	1570	1510	1480	1590	35
	(*854·4*)	(*821·1*)	(*804.4*)	(*865·5*)	
4.40	1670	1570	1550	1670	40
4.45	1730	1640	1610	1710	45
4.50	1750	1640	1630	1750	50
	(*954·4*)	(*893·3*)	(*887·7*)	(*954·4*)	
4.55	1730	1660	1650	1730	55
5.0	1760	1660	1650	1760	60
5.5	1810	1700	1700	1790	65
	(*987·7*)	(*926·6*)	(*926·6*)	(*976·6*)	
5.10	1830	1740	1720	1810	70
5.15	1820	1750	1720	1810	75
5.20	1870	1790	1770	1850	80
	(*1021·1*)	(*976·6*)	(*965·5*)	(*1010*)	
5.25	1870	1800	1800	1870	85
5.30	1870	1800	1800	1870	90
5.35	1900	1830	1840	1890	95
	(*1037·7*)	(*998·8*)	(*1004·4*)	(*1032·2*)	
5.40	1930	1870	1870	1910	100
5.45	1940	1880	1890	1930	105
	(*1060*)	(*1026·6*)	(*1032·2*)	(*1054·4*)	

Degrees in italics are in Centigrade.



	Minutes Elapsed.
At 4 p.m. the gas was turned on and lit.	0
At 4.15 p.m. steam began to rise between the edge of the beams and the wall of hut, and continued to do so till 4.40 p.m.	15
At 5.5 p.m. the beams carrying the load began to sag.	65
At 5·35 p.m. the sagging had increased to 2 in. (·0507 *m.*), and cracks appeared on the inside transversely across the beams in the centre.	95

Minutes Elapsed.

At 5.42 p.m. the transverse cracks across the beams increasing in number and width. 102

At 5.46 p.m. five of the beams on the east side collapsed on the east side, falling inside the hut with part of the load. 106

At 5.47 p.m. the gas was turned off. 107

At 5.49 p.m. water was applied to the soffit of the remaining portion at 40 lbs. pressure, which washed the lower surface of the beams away to a small extent, where struck by the water. 109

At 5.51 p.m. the water was shut off and the test concluded. 111

OBSERVATIONS AFTER TEST.

(*See Figs.* 9, 10, 11, *and* 12.)

On August 13th the remaining load was removed.

The remaining portion of the floor was still in position, but was sagged to the extent of 5½ in. (·*139 m.*), and showed three longitudinal cracks on the top surface.

The soffit of the beams had been washed away where struck by the jet.

The concrete was not much deteriorated.

Some of the rods were exposed, but were not fused.

Fig. 9. VIEW TAKEN AFTER TEST SHOWING THE PORTION OF THE FLOOR THAT COLLAPSED.

Fig. 10. VIEW LOOKING WEST, TAKEN AFTER TEST AND AFTER THE LOAD HAD BEEN REMOVED.

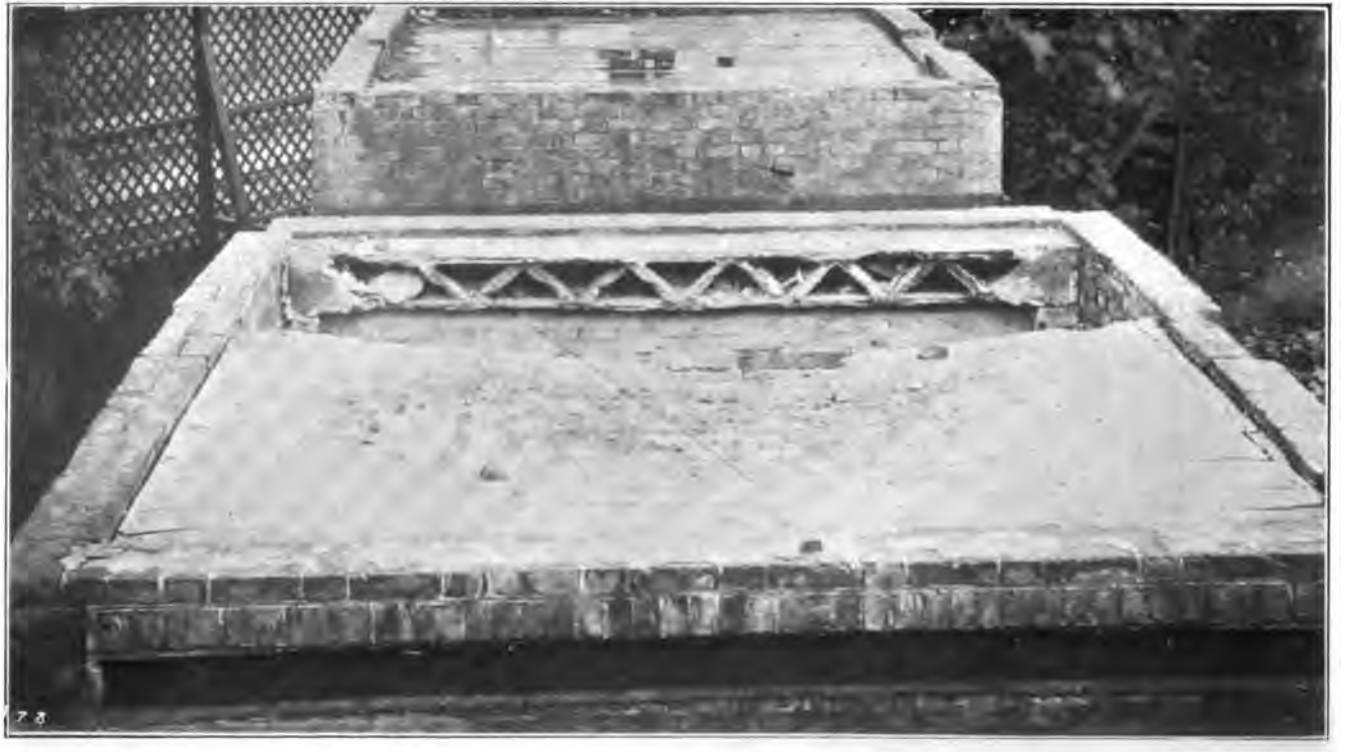


Fig. 11. VIEW LOOKING EAST, TAKEN AFTER TEST AND AFTER THE LOAD HAD BEEN REMOVED.

Fig. 12. VIEW SHOWING THE INTERIOR OF THE HUT AND THE COLLAPSED BEAMS.

GENERAL ARRANGEMENTS.

The test was carried out in accordance with the procedure laid down by the Executive for investigations of this description, and conducted by a sub-committee comprising :—

Mr. Ellis Marsland, District Surveyor, Camberwell (*Directing Member*).
Mr. James Sheppard.
Hon. Captain Dyer, Vice-President, N.F.B.U.,

Mr. Thomas Kissack, Resident Engineer at the Testing Station, assisted the Sub-Committee.

Mr. Edwin O. Sachs was in attendance on behalf of the Executive.

The general body of Members was represented by :—

Lieut.-Col. Geo. Dixon, Vice-President, N.F.B.U.
E. R. Hewitt, District Surveyor of St. Saviour's, Southwark and North Lambeth.
Geo. Monckton, M.A.

The Commercial Section was represented by :—

J. D. O'Brien, Columbian Fireproofing Company.

Messrs. Visintini & Weingärtner were represented by :—

G. Weingärtner, H. Merck, and E. Merck.

The following visitors attended by special invitation of the Executive :—

A. Ashbridge, District Surveyor of St. Marylebone.
W. J. Church Brasier, Chairman, London Private Fire Brigades Association.
P. O'Brien, Pittsburg, U.S.A.
P. Power, The Patent Impervious Stone Company.

Signed,

For the Sub-Committee conducting Test:

ELLIS MARSLAND (*Directing Member*).

For the Executive:

EDWIN O. SACHS (*Chairman*).

Published by the Committee as directed by the Executive.

CHARLES ADAMI
(*Assist. Secretary*).

Date—18th September, 1903.

Verified a true copy of the Report ordered to be published.

ROSE INNES, SON, AND CRICK
Solicitors.

Date—30th September, 1903

PUBLICATIONS OF THE BRITISH FIRE PREVENTION COMMITTEE

(Continued from Second Page of this Publication.)

49. FIRE TESTS WITH DOORS. A 2⅜-in. Door of Archangel Deal constructed in Three Thicknesses; a 2⅜-in. Door of Quebec Pine constructed in Three Thicknesses. Particulars of Experimental Fire Tests.
50. FIRE TESTS WITH DOORS. A 2⅜-in. Door of Archangel Deal constructed in Three Thicknesses; a 1⅜-in. Door of Teak, Flush Panelling on each side, the Panels being in Two Thicknesses. Particulars of Experimental Fire Tests.
51. FIRE TESTS WITH FIRE-RESISTING CURTAINS. Two Fire Blinds, known as the "Williams" Fire Blinds, installed by G. A. Williams & Son, Bayswater, London. The Committee's Report.
52. FIRE TESTS WITH PARTITIONS. A Partition formed with "Mack's" Patent Slabs, and erected by M. J. A. King & Co., London. The Committee's Report.
53. FIRE TESTS WITH PARTITIONS. A Partition known as the "Cunnah-Wright" Partition, by the Fireproof Partition Syndicate, Ltd., London. The Committee's Report.
54. FIRE TESTS WITH DOORS. A 2⅜-in. Door of Oak constructed in Three Thicknesses; a 2⅜-in. Door of Teak constructed in Three Thicknesses. Particulars of Experimental Fire Tests.
55. FIRE TESTS WITH FLOORS. A Floor of Deal Joists and Coke Breeze Concrete with Expanded Metal and Plaster Ceiling. Particulars of Experimental Fire Tests.
56. FIRE TESTS WITH FLOORS. A Floor by the Mural and Decorations Syndicate, Ltd., London, being a Double Test. The Committee's Report.
57. FIRE TESTS WITH TREATED WOOD. A Match-boarded Partition of Deal painted with Oil-colour; a Match-boarded Partition of "Non-Flammable" Deal painted with "Non-Flammable" Paint by the London Non-Flammable Wood Company, Ltd., London. The Committee's Report.
58. FIRE TESTS WITH PARTITIONS. A Partition known as the "Cunnah-Wright" Partition, by the Fireproof Partition Syndicate, Ltd., London. The Committee's Report.
59. FIRE TESTS WITH DOORS. An Ordinary 4-Panelled Deal Door; an ordinary Ledged Deal Door. Particulars of Experimental Fire Tests.
60. FIRE TESTS WITH DOORS. Two Iron Doors. Particulars of Experimental Fire Tests.
61. FIRE TESTS WITH FLOORS. A Floor of Steel Joists with Coke Breeze Concrete. Particulars of Experimental Fire Tests.
62. FIRE TESTS WITH CEILINGS. A Wood Floor and Ceiling protected by an Additional Suspended Ceiling by Banks' Fireproof Construction Syndicate, Ltd., London. The Committee's Report.
63. FIRE TESTS WITH PARTITIONS. A Partition erected by Banks' Fireproof Construction Syndicate, Ltd., London. The Committee's Report.
64. FIRE TESTS WITH FLOORS. A Floor by Banks' Fireproof Construction Syndicate, Ltd., London. The Committee's Report.
65. The Testing Arrangements of the British Fire Prevention Committee. Some Notes with Illustrations. By ELLIS MARSLAND.
66. FIRE TESTS WITH AUTOMATIC FIRE ALARMS. Closed Circuit and Open Circuit Automatic Fire Alarms, by Pearson's Fire Alarm System, Ltd., London. The Committee's Report.
67. FIRE TESTS WITH DOORS. A Door composed of Deal and Uralite covered externally with Tinned Steel; a Door composed of Deal and Uralite covered externally with Uralite, by the British Uralite Company, Ltd., London. The Committee's Report.
68. FIRE TESTS WITH DOORS. A 1¾-in. Framed "Jarrah" Door, with 1¾-in. Solid Panels; a 1¾-in. Framed "Karri" Door, with 1¾-in. Solid Panels, by Messrs. Millars' Karri and Jarrah Forests, Ltd., London. The Committee's Report.
69. FIRE TESTS WITH DOORS. Two 2-in. Doors of Deal, hung in one opening, with a space between the Doors; two 2-in. Doors of Oak, hung in one opening, with a space between the Doors. Particulars of Experimental Fire Tests.
70. FIRE TESTS WITH DOORS. A 2-in. "Jarrah" Four-Panel Bead Flush Both Sides Door; a 2-in. "Karri" Four-Panel Bead Flush Both Sides Door, by Messrs. Millars' Karri and Jarrah Forests, Ltd., London. The Committee's Report.
71. FIRE TESTS WITH FLOORS. A Floor by Messrs. Millars' Karri and Jarrah Forests, Ltd., London. The Committee's Report.
72. FIRE TESTS WITH ROOFS. A Slated Roof and Ceiling; a Flat Roof covered with Vulcanite Roofing and Ceiling, by the Vulcanite, Ltd., London and Belfast. The Committee's Report.
73. FIRE TESTS WITH FLOORS. A Floor of Fir Supports and Oak Flooring. Particulars of Experimental Tests.
74. FIRE TESTS WITH PARTITIONS. A Partition formed with Phœnix Fire-Resisting Slabs, erected by Messrs. Van der Vygh Bros., Amsterdam. The Committee's Report.
75. INTERNATIONAL FIRE PREVENTION CONGRESS, 1903, convened by the Executive of the British Fire Prevention Committee. Record of Congress Organisation, Programme and Resolution.
76. FIRE TESTS WITH DOORS. Two Doors constructed of Deal and covered externally (*i.e.*, "armoured") with Tinned Steel Plates, one hung on hinges and the other made to slide, by the Curfew Armoured Fire Door Company, Manchester. Particulars of Experimental Fire Tests.
77. FIRE TESTS WITH DOORS. Two Doors constructed of Deal and covered externally (*i.e.*, "armoured") with Tinned Steel Plates, one hung on hinges and the other made to slide, by the Curfew Armoured Fire Door Company, Manchester. The Committee's Report.
78. FIRE TESTS WITH FLOORS. A Floor of Concrete Beams reinforced with Iron Rods, by Messrs. Visintini and Weingärtner, Zürich. The Committee's Report.
79. FIRE TESTS WITH FLOORS. A Floor of Karri Wood, by Millars' and Jarrah Forests, Ltd. Particulars of Experimental Fire Tests

UNWIN BROTHERS, LIMITED, THE GRESHAM PRESS, WOKING AND LONDON.

Publications of the

BRITISH FIRE PREVENTION COMMITTEE.—No. 79.

Edited by Edwin O. Sachs.

FIRE TESTS WITH FLOORS

A FLOOR OF KARRI WOOD

BY

MILLARS' KARRI AND JARRAH FORESTS (1902), LTD.

Particulars of Experimental Test

ALL RIGHTS RESERVED.

LONDON, 1903.

PUBLISHED AT THE OFFICES OF
THE BRITISH FIRE PREVENTION COMMITTEE
(Founded 1897—Incorporated 1899),
1, WATERLOO PLACE, PALL MALL.

Two Shillings and Sixpence.

Standards of Fire-resistance.

Based on these investigations, they have defined standards of fire-resistance for various forms of construction which have been accepted as practical, not only in this country, but also in the United States and the Continent of Europe.

Reports and Publications.

The reports on the various Tests were issued from time to time in 57 Red Books.

During the period they have also issued 22 publications on other matters relating to the prevention of, and some of the results of actual, fires.

The total number of ordinary publications issued is 79.

The Metric System.

The metric system has, since July last, been adopted in the Committee's publications in order to enhance their international utility.

Various services rendered.

The Committee has given evidence before the Parliamentary Select Committee on Fire Brigades; they have from time to time prepared replies to inquiries on various technical matters relating to the subjects put before them by the Secretary of State for Home Affairs, by various Public Authorities, Societies, and individuals; they have twice prepared and presented to the L.C.C. observations on the recently proposed Amendments to the Building Act, and have from time to time called the attention of various Public Authorities and the Public Press to matters of a like nature.

Popularising the Subject.

They have endeavoured to popularise the subject of Fire Protection and Fire Prevention generally by, among other efforts, organising a special section of the Building Trades Exhibition in 1901; by participating in the organisation of the Berlin Fire Exhibition of 1901; and by organising the technical side of the International Fire Exhibition at Earls Court, London, 1903.

The effect of this exhibition—which was unique in its kind and highly instructive—is generally considered to be far-reaching on the general development of the subject.

International Fire Exhibition.

The International Fire Exhibition of 1903 is the subject of a most comprehensive record fully illustrated, and issued from the offices of the Committee, which explains the scope, influence, utility, and successful technical results of this Exhibition.

H.R.H. the Duke of Cambridge and Advisory Council.

The President of the Hon. Advisory Council of the Exhibition was H.R.H. the Duke of Cambridge; the Vice-Presidents were the Right Hon. the Lord Mayor of London, his Grace the Duke of Marlborough, K.G., and the Chairman of this Committee. The Advisory Council numbered 66 members. There were numerous representative sub-Committees.

International Fire Prevention Congress.

The Executive have convened and organised an International Fire Prevention Congress, the first of its kind, at which members of the various professions and services interested met on common ground. The Congress membership comprised 840, including official delegates from six of our Government Departments, 15 foreign and Colonial Governments, and 200 public authorities, municipalities, and learned Societies.

The Right Hon. the Lord Mayor.

The Congress was opened by the Right Hon. the Lord Mayor of London in State, the opening being attended, among others, by the First Commissioner of Public Works and the Parliamentary Under-Secretary of State for Home Affairs.

Report of the Congress.

The Report of the Congress, prepared by the Executive, comprises an illustrated folio volume of 200 pages, fully descriptive of the scope, transactions, and Resolutions of this Conference, the influence of which can already be observed.

H.M. the King.

A copy of this Official Report has been graciously accepted by His Majesty the King, who also sent a message of encouragement to the assembled members at the time of the gathering.

Foreign Sovereigns and Presidents.

Copies of the Report have been accepted by the Sovereigns and Presidents of various Foreign States, by the leading Government Departments at home, and by various Foreign Governments.

Over 1,200 copies of the Report have been presented by the Committee to various technical and corporate bodies and individuals interested in the subject.

Distinctions accorded to the Committee.

In recognition of the Committee's efforts a large silver medal was received in 1901 from Her Majesty the German Empress in connection with the International Fire Exhibition of Berlin, and a specially struck gold medal was presented to the Committee by the Italian Government on the occasion of the Congress in London of 1903.

Special Sections.

The Committee is in touch with the leading manufacturers of materials, &c., claiming to be fire resisting through the medium of a small advisory Commercial Section, the members of which met several times to put forward views as to the arrangements for testing. The functions of the Section are advisory.

The creation of an Industrial Section of the Committee, through which large employers of labour and owners of property may be enabled to obtain information and benefit from their publications, is in course of formation.

Hon. Corresponding Members abroad.

There has been a constant interchange of correspondence with those interested in the subject in the Colonies and abroad, and with the hon. corresponding members of the Committee.

Collections.

The Executive have commenced the arrangement of a collection of relics and photographs of materials tested, with the view of forming a Museum.

Library.

A Library has been formed which shall be the nucleus of a valuable collection on the subject. Some sixty technical journals are kept on file at the Committee's offices.

Financial arrangements.

The financial arrangements of the Committee have been the subject of considerable anxiety to the Executive from the outset, for, whilst it was considered probable that the ordinary routine work and propaganda of the Committee could within the first ten years become self-supporting, it was obvious that the thorough investigation of the fire-resistance of materials and systems of construction, which the Executive considered essential (both in respect to ordinary materials and systems of construction and to proprietary articles or systems), must necessarily be of a very costly character.

Original lack of Financial Support.

As neither the public authorities, nor professional societies at the time of formation of the Committee accorded the question of Fire Prevention such importance to justify the Executive's applications for contributions to research work of this kind, and as the general public also was quite apathetic as to the subject, the only resource lay in voluntary subscriptions by the professional members interested, and by charging testing fees to those firms who wish to have proprietary articles or systems tested. Hence the work of the Committee was from the outset materially handicapped, and they have had to limit the scope of their work from lack of funds.

Financial Assistance rendered by Members of the Executive.

For preliminary capital expenses, individual members of the Executive first assisted by temporary loans, a considerable portion of which was afterwards changed into standing loans against 5 per cent. Debentures. The

standing loans thus voluntarily provided by past and present members of the Executive amount to £2,460 on December 31, 1903, and the temporary loans to £1,081 17s. 4d., together £3,541 17s. 4d. These loans enabled the work to be carried out, but it is hoped that they may gradually be refunded as the membership and testing operations of the Committee develope.

Change of Testing Station.

The Committee, in the early stages of its operations, unfortunately found it necessary to remove its Testing Station from the original site at North Bank, Regent's Park, this site being required by the owners for other purposes, and the conditions of the Committee's lease did not allow for any compensation for short notice. Their removal was not only expensive in itself, but it brought with it additional expenditure for improved testing chambers, &c., and special expenditure had likewise to be incurred in fitting up the new committee rooms and a resident engineer's tenement. It should be added that the considerable break caused in the testing operations by their removal was by no means advantageous to the financial side of the Committee's testing work.

Location of Testing Station.

Regarding the arrangements as to obtaining ground suitable for testing purposes, it was found exceedingly difficult to obtain a suitable site within the four-mile cab radius. Landlords as a rule look with disfavour upon the possible dangers and nuisance attending experimental work of this kind, although these troubles are more imaginary than real. Even now the present station is held on sufferance.

Expensive character of the Investigations.

Although the sum expended on the investigations may appear very high, those fully acquainted with the details of such work will appreciate the reasons for the expenditure. Had the work not been carried out in a thoroughly reliable and consequently expensive manner, the value of

the investigations would have been doubtful, for it was found that even an attempt to economise in the printing of the Committee's Reports would spoil the record of the results obtained, as the illustrations, if not perfectly reproduced, would not properly show essential features.

Details of Expenditure.

The present time may be considered a suitable one for giving some more detailed particulars of the expenditure than have ever been given in the annually audited summary of accounts.

Bookkeeping.

From the incorporation of the Committee, until December 31, 1902, two separate accounts were kept, *i.e.*, No. 1 Account, the Committee's General Fund, and No. 2 Account, the Testing Station Fund; the former dealing with the Head Office, general and publication expenditure, and the latter with the Testing Station and the experimental work. In 1903 these accounts were amalgamated into one account. The accounts have been audited every year.

Analysis.

For the purpose, however, of obtaining a clear insight into the expenditure, the following analysis has been arranged, showing the sums expended and liabilities incurred up to the end of 1903, *i.e.*, after a period of nearly five years' operations as an incorporated body, but including the deficit, of £428 14s. 4d., incurred in the period of fifteen months, prior to incorporation.

Summary of Expenses, Five Years, ending December 31, 1903.

Expenses.	1899. £ s. d.	1900. £ s. d.	1901. £ s. d.	1902. £ s. d.	1903. £ s. d.	Total. £ s. d.
By Preliminary Expenses prior to Incorporth.	428 14 4	...	...	...	...	428 14 4
„ Incorporation and General Legal Expenses	26 0 0	...	142 9 5	125 0 0	116 13 8	410 3 1
„ Office Rent	105 0 0	105 0 0	194 8 0	155 12 0	155 12 0 *77 16 0	793 8 0
„ Office Salaries ...	373 16 1	282 15 5	291 6 6	217 19 1	166 19 6	1,330 16 7
„ Stationery	58 14 6	75 12 4	3 19 6	138 16 2	13 15 3	290 17 9
„ Printing, Engraving, and Binding ...	182 4 2	658 14 4	559 18 1	100 6 7	562 2 0 *91 9 4	2,097 14 6
„ Furniture	23 12 6	36 0 0	13 6 9	...	113 12 6	186 11 9
„ Postages and Telegrams	81 3 11	81 12 0	63 11 2	53 14 9	51 18 8 *26 11 11	358 12 5
„ Travelling Expenses	27 11 11	33 7 8	49 8 7	23 9 10	3 13 2	137 11 2
„ Accountants' Charges	...	...	...	...	156 6 0	156 6 0
„ Bankers' Charges ...	16 13 3	25 13 7	9 7 9	2 0 6	6 2 2	59 17 3
„ Debenture Interest ...	...	...	...	...	70 19 0 *86 8 0	157 7 0
„ Special and Sundry Expenses	76 3 11	35 10 8	79 17 2	144 12 8	267 12 10 *9 0 6	612 17 0
						7,020 17 7
Testing Station.						
By Rent, Rates, &c. ...	218 17 10	153 11 2	81 16 10	167 4 8	284 16 5 *56 0 0	662 6 11
„ Equipment	970 19 9	143 10 0	288 10 0	660 1 1	26 12 2 *801 5 6	2,890 18 6
„ Materials	60 10 2	167 3 11	76 8 7	42 1 10	22 6 0	368 10 6
„ Instruments	22 12 0	2 2 6	44 17 9	...	*4 8 6	74 0 9
„ Wages	468 16 3	436 0 2	74 15 3	149 0 6	18 4 0	1,146 16 2
„ Gas, Coal, and Coke	52 17 3	53 19 7	49 6 3	30 19 10	7 0 7 *9 7 0	203 10 6
„ Entertaining ...	34 8 0	108 19 6	80 13 6	1 0 0	53 2 1	278 3 1
„ Photography	48 5 7	126 5 7	42 4 11	71 19 0	16 2 6 *9 19 11	314 17 6
„ Sundry Expenses ...	22 1 0	64 13 1	66 5 7	70 2 3	21 6 5 *23 10 3	267 18 7
						13,528 0 1
Congress Account ... † Deficit	...	...	...	...	13 6 9	13 6 9
	3,299 2 5	2,588 11 6	2,212 11 7	2,154 0 9	2148 3 8 *1138 16 11	13,541 6 10
„ Cash at Bank ...	...	...	...	...	...	41 13 7
„ Cash in Hand ...	...	...	...	...		2 5 7
						£13,585 6 0

* Deficit. † Contingent Liability, £228 10s. 8d., of which paid on a c, £13 6s. 9d.

An analysis of the tests shows that of the 79 tests undertaken by the Committee, 15 were floor tests, 11 were partition tests, 33 were door tests, 8 were tests of glazing, 3 were ceiling tests, and 9 were tests with materials and appliances. The Reports on these tests are, as above said, embodied in 57 publications. Character of Tests.

Including the capital outlay to date the Testing Station *per se* and its conduct has cost £6,507 2s. 6d. Cost of Tests.

The average cost per test (irrespective of the publications of the report, or any head-office charges) has hence been £82 7s. 6d.

The general head-office charges, including stationery and printing, have been £7,020 17s. 7d., inclusive of capital outlay, and as at least one-half of the Committee's general expenses has been incurred for work at the testing station (for alone fully two-thirds of its publications have been devoted to tests), each of the 79 tests should be accorded from head-office expenses an additional item of expenditure of, say, £44 8s. 8d. This makes the real average cost of a test, in round figures, £127. Average cost of Tests.

It should be remembered that the actual skilled *conduct and supervision of the tests as also the preparation of the reports by the members are of a voluntary character*, no fees of any kind, or even out-of pocket disbursements being paid to the members. Voluntary Services.

It may be of interest here to note that as far as the proprietor or owner of a material or system under investigation is concerned, his testing charge ranks from £65 for an ordinary test with a minor appliance, to £185 for the large floor test, or, say, an average of £125. It will hence be observed that even the testor's testing charge is practically at cost, or if anything below cost, seeing that most of the makers' tests are of the heavier and more time-taking ones. It is, however, doubtful Testing charges for patented matter.

whether makers would incur a heavier testing charge than that at present necessary, so that this item of income cannot be increased.

Economical arrangements of Tests.

In fact, economy can only be effected in the cost of a test by arranging for two or more to take place within a limited number of months in rapid succession, and, if possible, two tests per day on a testing day, so that the general expenses of a testing operation may be spread as nearly as possible over more than one test.

Ideal Testing Station.

The ideal Testing Station, however, is one where the Committee can afford to test any material or system it selects, without requiring any payment from a testor where proprietary articles are concerned or in fact involving him in any expenditure. But it must be a long time until the increase of funds will permit the Committee to reach this ideal, unless some public benefactor appreciates the importance of the matter in the interests of safety to life, and gives financial assistance.

Total Expenditure.

The total expenditure of the Committee has been £13,541 6s. 10d., of which £6,507 2s. 6d. was direct testing station expenditure *per se*, and £7,020 17s. 7d., general and establishment expenditure, (including the substantial sum of £2,097 14s. 6d. for printing, engraving, &c.).

SUMMARY OF RECEIPTS AND EXPENDITURE.

Dr. *Five Years, ending December 31, 1903.* Cr.

RECEIPTS.	£	s.	d.	EXPENDITURE.	£	s.	d.
To Income from various sources ...	3,967	5	1	By Working Expenses	7,020	17	7
,, Standing Loans	2,460	0	0	,, Balance at Bank and in hand ...	43	19	2
,, Temporary Loans	1,081	17	4	,, Congress Expenses (Deficit a c)	13	6	9
Testing Station.				*Testing Station.*			
,, Sundry Receipts	4,937	6	8	,, Equipment & Working Expenses	6,507	2	6
	12,446	9	1				
,, Balance by Deficit	1,138	16	11				
	£13,585	6	0		£13,585	6	0

Summary of Expenditure and Income.

Against the expenditure of £6,507 2s. 6d. on the Testing Station there has been a Testing Station income of £4,937 6s. 8d.

Against the general expenditure of £7,020 17s. 7d. there has been a total of £3,112 16s. 2d. in subscriptions, donations, sundry receipts, &c., and £854 8s. 11d. for publications sold, &c., together £3,967 5s. 1d.

The General work (with the addition of a special item of £13 6s. 9d.) shows a loss of	£3,066 19 3
The Testing Station shows a loss of	1,569 15 10
Aggregate Loss	£4,636 15 1

The aggregate loss is met in part, as explained above, by £2,460 standing loans, £1,081 17s. 4d. temporary loans, together £3,541 17s. 4d. This shows an actual cash deficit, after allowing for cash at bank and in hand at December 31, 1903, £1,094 17s. 9d. (*i.e.*, £1,138 16s. 11d., less £43 19s. 2d.).

Original Members of the Executive.

Since the incorporation of the Committee the eight original signatories and four other members have from time to time served on the Executive. Of the original eight signatories four members are still serving on the Executive.

Meetings of the Executive.

The number of Executive meetings for the period since the date of incorporation has been 73.

Sub-Committees

There were numerous (over 200) sub-Committee meetings, principally in connection with the questions of standardising of tests and in connection with the Congress and exhibitions.

Work of the Executive Members.

There were sixty-eight sub-Committees entrusted from time to time with the conduct of and report upon tests.

The average executive meeting lasted three hours. The average time that had to be occupied by a testing sub-committee was three afternoons.

Voluntary Workers.

All this work, as has already been indicated, was done voluntarily, and in all instances the workers had to bear their own expenses.

Members of the Committee.

The number of members in the British Fire Prevention Committee on December 31, 1903, is 256.

There are also 51 Honorary Corresponding members of the Committee.

In the Advisory Sections, the Commercial Section has 44 subscribers. The Industrial Section, which is being formed, has commenced with 9 subscribers.

The late Mr. Arthur Cates.

In conclusion the Executive would like to take the opportunity of this Quinquennial Report to point to the great services rendered to the Committee by the late Mr. Arthur Cates in the earlier period of its organisation and in the formation of its Testing Station.

Acknowledgment of assistance rendered.

The Executive are desirous of expressing their sincerest gratitude to such of the members of the Committee who have assisted in carrying out the testing duties. They further wish to thank the many helpers who have, in various spheres, assisted the Committee from time to time. Among the latter the Executive particularly wish to associate the executive officers of the National Fire Brigades' Union.

Presented by the Executive and adopted at the Annual General Meeting on March 30th, 1904.

EDWIN O. SACHS (*Chairman*).
ELLIS MARSLAND (*Gen. Hon. Secretary*).

1, Waterloo Place,
Pall Mall, London, S.W.

The British Fire Prevention Committee.

THE EXECUTIVE'S ANNUAL REPORT FOR 1903.

The Executive presents, herewith, the Annual Statements of Receipts and Payments for the year 1903.

In order to simplify the accounts the two separate accounts known previously as the General Account and the Testing Station Account have been amalgamated.

No special report of the Committee's work for the year 1903 has been prepared, having regard to the preparation of the Executive's Quinquennial Report, dealing with the Committee's operations since its incorporation.

Presented by the Executive and adopted at the Annual General Meeting on March 30th, 1904.

EDWIN O. SACHS (*Chairman*).

ELLIS MARSLAND (*Gen. Hon. Secretary*).

COMBINED GENERAL AND TESTING STATION ACCOUNT.

Summary of Receipts and Payments for the Year ending December 31, 1903.

Dr. **Cr.**

RECEIPTS.	£	s.	d.	PAYMENTS.	£	s.	d.
To Balance brought forward from last year...	9	8	8	By Working Expenses	1685	6	9
„ Income from various sources ...	1844	13	8	„ Balance at Bank and in hand ...	43	19	2
„ Sundry Loans	57	4	0	„ Congress Expenses (*deficit a c*) ...	13	6	9
Testing Station.				*Testing Station.*			
„ Balance brought forward	4	7	6	„ Equipment and Working Expenses	449	10	2
„ Sundry Receipts	226	9	0				
	£2192	2	10		£2192	2	10

I have examined the above Statements of the Committee's General Fund and Testing Station Fund Accounts and have duly vouched the same and verified the Bank Balances and hereby certify the correctness thereof. In addition to the Loans owing on December 31, 1903, there were on that date debts for goods and otherwise, amounting to £1,138 10s. 11d. Two hundred and forty-six First Mortgage Debenture Bonds of ten pounds each (part of an issue of £7,500 authorised by the Committee) are held as security for certain of these debts.

(*Signed*)

HORACE S. FOLKER,
Hon. Auditor.

I have examined the accounts mentioned in the above certificate with Mr. Horace S. Folker and such vouchers as I have called for, and I am satisfied as to the correctness of the same.

(*Signed*)

GEO. W. DIXON,
Hon. Auditor.

March 16, 1904.

The British Fire Prevention Committee's Standards of Fire Resistance.

AS ADOPTED TO SERVE AS

UNIVERSAL STANDARDS

AT THE

INTERNATIONAL FIRE PREVENTION CONGRESS, LONDON, 1903.

The following were the Congress Resolutions referring to the subject:—

Re the term "Fireproof."

THE Congress having given their consideration to the constant misuse of the term "fireproof," and its indiscriminate and unsuitable application to many building materials and systems in use, have come to the conclusion that the avoidance of this term in the general business and technical vocabulary is essential.

Re the term "Fire-resisting."

THE Congress considers the term "fire-resisting" more applicable for general use, and that it more correctly describes the varying qualities of the different materials and systems of construction intended to resist the effect of fire for shorter or longer periods, at high or low temperatures, as the case may be; and it advocates the general adoption of this term in the place of the term "fireproof."

Re Standards of Fire Resistance.

THE Congress confirms the British Fire Prevention Committee's proposed standards of fire-resistance, and hereby resolves that the universal standards of fire-resistance shall in future be:—

1. *Temporary protection;*
2. *Partial protection;*
3. *Full protection;*

in accordance with the Committee's schedule.

The executive of the British Fire Prevention Committee having given their careful consideration to the common misuse of the term "fireproof," now indiscriminately and often most unsuitably applied to many building materials and systems of building construction in use in Great Britain, have come to the conclusion

that the avoidance of this term in general business, technical, and legislative vocabulary is essential.

The executive consider the term "fire-resisting" more applicable for general use, and that it more correctly describes the varying qualities of different materials and systems of construction intended to resist the effect of fire for shorter or longer periods, at high or low temperatures, as the case may be, and they advocate the general adoption of this term in place of "fireproof."

Further, the executive, fully realising the great variations in the fire-resisting qualities of materials and systems of construction, consider that the public, the professions concerned, and likewise the authorities controlling building operations, should clearly discriminate between the amount of protection obtainable or, in fact, requisite for different classes of property. For instance, the city warehouse filled with highly inflammable goods of great weight requires very different protection from the tenement house of the suburbs.

The executive are desirous of discriminating between fire-resisting materials and systems of construction affording *temporary* protection, *partial* protection, and *full* protection against fire, and to classify all building materials and systems of construction under these three headings. The exact and definite limit of these three classes is based on the experience obtained from numerous investigations and tests, combined with the experience obtained from actual fires, and after due consideration of the limitations of building practice and the question of cost.

The executive's minimum requirements of fire-resistance for building materials or systems of construction will be seen from the standard tables appended for—

I. Fire-resisting floors and ceilings,

II. Fire-resisting partitions,

III. Fire-resisting doors,

but they could be popularly summarised as follows :—

(*a*) That temporary protection implies resistance against fire for at least three-quarters of an hour.

(*b*) That partial protection implies resistance against a fierce fire for at least one hour and a-half.

(*c*) That full protection implies resistance against a fierce fire for at least two hours and a-half.

The conditions under this resistance should be obtainable, the actual minimum temperatures, thickness, questions of load, and the application of water can be appreciated from the annexed tables by all technically interested, but for the popular discrimination—which the executive are desirous of encouraging—the time standard alone should suffice.

It is desirable that these standards become the universal standards in this country, on the Continent, and in the United States, so that the same standardisation may in future be common to all countries, and the preliminary arrangements for this universal standardisation are already in hand.

On behalf of the Executive

EDWIN O. SACHS (*Chairman*).

ELLIS MARSLAND (*Gen. Hon. Secretary*).

STANDARD TABLE FOR FIRE-RESISTING FLOORS AND CEILINGS.

Classification.	Sub-Class.	Duration of Test at Least.	Minimum Temperature.	Load per Superficial Foot Distributed.	Minimum Superficial Area under Test.	Minimum Time for Application of Water under Pressure.
Temporary Protection	Class A	45 mins.	1500° F.	Optional	100 sq. ft.	2 mins.
	Class B	60 mins.	1500° F.	Optional	200 sq. ft.	2 mins.
Partial Protection	Class A	90 mins.	1800° F.	1 cwt.	100 sq. ft.	2 mins.
	Class B	120 mins.	1800° F.	1½ cwt.	200 sq. ft.	2 mins.
Full Protection	Class A	150 mins.	1800° F.	2 cwt.	100 sq. ft.	2 mins.
	Class B	240 mins.	1800° F.	2½ cwt.	200 sq. ft.	5 mins.

STANDARD TABLE FOR FIRE-RESISTING PARTITIONS.

CLASSIFICATION.	Sub-Class.	Duration of Test at Least.	Minimum Temperature.	Thickness of Material.	Minimum Superficial Area under Test.	Minimum Time for Application of Water under Pressure.
Temporary Protection	Class A	45 mins.	1500° F.	2 in. & under	80 sq. ft.	2 mins.
	Class B	60 mins.	1500° F.	Optional	80 sq. ft.	2 mins.
Partial Protection	Class A	90 mins.	1800° F.	2½ in. & under	80 sq. ft.	2 mins.
	Class B	120 mins.	1800° F.	Optional	80 sq. ft.	2 mins.
Full Protection	Class A	150 mins.	1800° F.	4½ in. & under	80 sq. ft.	2 mins.
	Class B	240 mins.	1800° F.	Optional	80 sq. ft.	5 mins.

STANDARD TABLE FOR FIRE-RESISTING SINGLE DOORS, WITH OR WITHOUT FRAMES.

CLASSIFICATION.	Sub-Class.	Duration of Test at Least.	Minimum Temperature.	Thickness of Material.	Minimum Superficial Area under Test.	Minimum Time for Application of Water under Pressure.
Temporary Protection	Class A	45 mins.	1500° F.	2 in. & under	20 sq. ft.	2 mins.
	Class B	60 mins.	1500° F.	Optional	20 sq. ft.	2 mins.
Partial Protection	Class A	90 mins.	1800° F.	2½ in. & under	20 sq. ft.	2 mins.
	Class B	120 mins.	1800° F.	Optional	20 sq. ft.	2 mins.
Full Protection	Class A	150 mins.	1800° F.	4½ in. & under	25 sq. ft.	2 mins.
	Class B	240 mins.	1800° F.	Optional	25 sq. ft.	5 mins.

Guesnet. Westphalen. Cherrier. Cockburn. Cordier. Szechenyi. Segundo.
Hexamer. Dittmann. Metaxas. Javal. Goldoni. Dixon. Heilbuth. Giersberg. Dyer. Clarke
Ratinckx. Folker. Sokoloff. Cazier. Stubben. Sheriff. Lvoff. Lord Mayor. Sachs. Lépine. Sheriff. Fox.

A GROUP OF THE CONGRESS MEMBERS, TAKEN ON MONDAY, JULY 6TH, 1903.

THE CONGRESS RESOLUTIONS.

The following is a copy of the valuable series of resolutions passed by the Congress :—

Re the term "Fireproof."

THE Congress having given their consideration to the constant misuse of the term "fireproof," and its indiscriminate and unsuitable application to many building materials and systems in use, have come to the conclusion that the avoidance of this term in the general business and technical vocabulary is essential.

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1. Temporary protection;
2. Partial protection;
3. Full protection;

in accordance with the Committee's schedule.

Re the Metric System.

THE Congress considers that in all reports dealing with questions of fire-resistance and tests, the metric system of measurement, weight, and temperature should be adopted as well as any local system.

Re "Testing Stations."

THE Congress strongly recommends the establishment of testing stations for fire-resisting materials and the adoption of a universally recognised method of testing; also the formation of a permanent International Technical Bureau, which shall meet at suitable periods to discuss, fix, and from time to time modify universal methods of testing.

Re Fire-resisting Materials and Building Legislation.

THE Congress considers it essential to revise from time to time local building regulations to bring them into accord with results obtained by the investigation of fire-resisting materials and methods of construction.

Re Technical Education.

THE Congress considers it essential that courses of study should be provided in universities, technical colleges, and schools for the instruction of engineering and architectural students in the fire-resistance of building materials and methods of construction as based on investigation.

Re Fire Brigades and Fire Prevention.

THE Congress considers that public authorities should encourage fire brigade officers to take an active interest in the preventive aspect of fire protection, inasmuch as the result of the fire brigade officers' experience in actual fire practice, if suitably applied in conjunction with the work of architects, engineers, and public officials, would be most useful for the organisation and development of precautionary measures.

THE Congress considers it of importance that fire brigades, societies, associations, and unions, should encourage amongst the brigades affiliated to these bodies the study of questions of fire prevention.

Re the Legal Status of Fire Brigades.

THE Congress considers it most necessary that fire brigades should be placed on a sound legal basis, and that it is advisable that their efficiency be supervised by a Government Department.

Re Records.

THE Congress considers that it is of the greatest importance that an official investigation should be made of all fires.

THE Congress considers that in the public interest it is of the utmost importance that on the occurrence of every fire an investigation should be immediately made by an official, duly qualified and empowered to ascertain the cause and circumstances connected therewith, reporting the result of such investigation to a public department for tabulation and publication.

THE Congress considers that the whole or part of the cost of such inquiry should be charged to the occupier of the premises where the fire occurred, as may appear desirable in the circumstances of each case.

Re Publication of Technical Fire Reports.

THE Congress considers it advisable that the Press should, from time to time, publish technical reports on fires so that the public may benefit from the knowledge and experience gained.

Re Maintenance of Private Fire Appliances.

THE Congress considers that greater attention should be accorded to the maintenance of private fire appliances where installed to meet local or insurance requirements.

Re Fire Insurance Rating.

THE Congress considers that a system of fire insurance rating which does not discriminate between safe and unsafe construction, and between carefulness and negligence, is an injury to the community.

Re Insurance Influence on Fire Prevention.

THE Congress considers that the Factory Mutual Insurance System as adopted in the United States, materially tends to the prevention of fire and the reduction of fire waste.

Re Theatre Safety.

THE Congress considers :

1. That the first essential for the safety of the public attending theatres is the provision of easy means of exit from the auditorium by *direct* and clear routes of exit as distinct from circuitous routes.

2. That next in importance to the provision of exits, the safety of the public requires the provision of suitable fire watches and careful fire survey with the view to the prevention of fire.

3. That the safeguard third in the scale of importance is the provision of automatic sprinklers over the stage.

4. That questions of suitable construction, fitting, and equipment only rank after the above three primary safeguards for the protection of the public.

Re Theatre Fire Service.

THE Congress considers:

1. That with the view of furthering the prevention and extinction of fires, fire watches in theatres should be manned from the public fire service.

2. That it is desirable to either provide the necessary movable fire appliances of a theatre from the public fire service, or to have powers to enforce uniformity of pattern and quality.

3. That theatres require a duplicate water supply service.

Re Lightning.

THE Congress considers that, having regard to the neglect of precautions against damage caused by lightning, the subject should have the serious consideration of the Government and local authorities, the technical professions and the fire service.

Re Spontaneous Combustion.

THE Congress considers that the dangers of spontaneous combustion are such as to make it essential for manufacturers, warehousemen, shipowners and others, to receive warnings from time to time as to the latest experience obtained and the precautionary methods advisable, and that reports upon instances of spontaneous combustion should be collected and summaries published at a recognised centre.

Re Popularising of Fire Prevention.

THE Congress considers that in order to popularise the subject, branches of the Fire Prevention Committees of different countries should be formed for large towns, as also for groups of rural districts or localities.

Consolidation and Uniformity in Legislation.

THE Congress considers that the consolidation of fire preventive and fire protective legislation is essential in all countries.

THE Congress considers that every government should embody the primary requirements of fire prevention and protection in a Fire Act, leaving local regulations to be drafted by local authorities to meet local requirements, such regulations, however, to be based on modern by-laws embodying fundamental principles and serving as a guide towards uniformity in the requirements for public safety.

Re International Publications.

THE Congress considers that the Technical Commission of the International Fire Brigades Council and the British Fire Prevention Committee conjointly, should be requested to consider the possible publication in three languages (English, German and French) of technical experience obtained at fires as an international publication or journal.

Re Congress Resolutions.

THE Congress considers that the Chairman and Gen. Hon. Secretary of the Congress should take the necessary steps to communicate the resolutions arrived at in this Congress to the Governments represented, and also to transmit copies of the Congress Report to these authorities.

LIST OF

The British Fire Prevention Committee's

PUBLICATIONS.

1. WHAT IS FIRE PROTECTION? A Study. By EDWIN O. SACHS.
2. AMERICAN OPINIONS ON FIRE PREVENTION. Abstracts from Papers. By EDWARD ATKINSON and others.
3. THE PARIS BAZAAR FIRE. A Paper, with Illustrations. By EDWIN O. SACHS.
4. THEATRE EXITS. A Paper. By ALFRED DARBYSHIRE, F.S.A., F.R.I.B.A.
5. NEW YORK FIRE DEPARTMENT. A Paper, with Illustrations. By HUGH BONNER, Chief Officer, New York.
6. COTTON FIRES AND COTTON BALES. A Paper, with Illustrations. By R. H SCOTTER, C.E.
7. FIRE-RESISTING FLOORS USED IN LONDON. A Paper, with Illustration. By FREDERICK FARROW, F.R.I.B.A.
8. FIRE SERVICE IN FACTORIES, WORKS, ETC. A Paper, with Illustrations. By HAROLD SUMNER.
9. LESSONS FROM FIRE AND PANIC. A Paper. By THOMAS BLASHILL, F.R.I.B.A., F.S.I., Superintending Architect to the London County Council.
10. HOW TO BUILD FIREPROOF. A Paper By FRANCIS C. MOORE, President of the Continental Insurance Co., New York.
11. FIRE TESTS WITH UNPROTECTED COLUMNS A Report by the Committee on "Fire-Proofing" Tests, New York.
12. THE EFFECT OF FIRE. A Report on the Horne Building Fire, Pittsburg, U.S.A., with Fourteen Plates and Illustrations.
13. THE B.F.P.C. TESTING STATION. Some Descriptive Notes, with Illustrations
14. FIRE TESTS WITH FLOORS. A Floor by the Expanded Metal Co.
15. CONFLAGRATIONS DURING THE LAST TEN YEARS. A Paper, with Twenty-Three Maps. By CHARLES E. GOAD, M.Am.Soc.C.E.
16. FIRE TESTS WITH FLOORS. A Floor of Wood Joists filled in with Concrete.
17. THE TALL BUILDING UNDER TEST OF FIRE. A Paper, with Illustrations. By H. de B. PARSONS.
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26. FIRE TESTS WITH DOORS. A 2-in. Framed Oak Door, with 2-in. Solid Panel; a 2-in Framed Teak Door, with 2-in. Solid Panels.
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32. FIRE TESTS WITH GLASS. Two Skylights glazed with Wired Glass by Messrs. Pilkington Bros.
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35. FIRE TESTS WITH DOORS. A 2-in. Framed Pitch Pine Door with 2-in. Solid Panels; a 2-in. Framed Deal Door with 2-in Solid Panels.
36. FIRE TESTS WITH TREATED WOOD. "Non-Flammable" Wood by the British Non-Flammable Wood Company, Ltd., London.
37. FIRE TESTS WITH PARTITIONS. A Partition erected by the "Gypsine" Brick Company, Ltd., London and Paris.
38. FIRE TESTS WITH FLOORS. A Floor by the "Gypsine" Brick Co., Ltd., London and Paris.
39. FIRE TESTS WITH DOORS. A 2-in. Framed Honduras Mahogany Door with 2-in. Solid Panels; a 2-in. Framed Poplar Door with 2-in. Solid Panels.
40. FIRE TESTS WITH DOORS. A 2 in. Framed Austrian Oak Door with 2-in Solid Panels; a 2-in. Framed American Walnut Door with 2-in. Solid Panels.
41. THE SAFETY OF THEATRE AUDIENCES AND THE STAGE PERSONNEL AGAINST DANGER FROM FIRE AND PANIC. A Paper. By WM. PAUL GERHARD.
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45. FIRE TESTS WITH FLOORS. A Floor and Ceiling by the Mural and Decorations Syndicate, Ltd., London.
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47. FIRE TESTS WITH PARTITIONS A Match-boarded Partition filled in with Silicate Cotton (Slag Wool) by Messrs. D. Anderson & Son, Ltd., London, and Messrs. J. C. Broadbent & Co., Ltd., London.
48. FIRE TESTS WITH FLOORS. A Floor of Deal Joists and Coke-Breeze Concrete.

4. FIRE TESTS WITH DOORS. A 2⅜-in. Door of Archangel Deal constructed in Three Thicknesses; a 2⅜-in. Door of Quebec Pine constructed in Three Thicknesses. Particulars of Experimental Fire Tests.
5. FIRE TESTS WITH DOORS. A 2⅜ in. Door of Archangel Deal constructed in Three Thicknesses; a 1⅜-in. Door of Teak, Flush Panelling on each side, the Panels being in Two Thicknesses. Particulars of Experimental Fire Tests.
51. FIRE TESTS WITH FIRE-RESISTING CURTAINS. Two Fire Blinds, known as the "Williams" Fire Blinds, installed by G. A. Williams & Son, Bayswater, London. The Committee's Report.
52. FIRE TESTS WITH PARTITIONS. A Partition formed with "Mack's" Patent Slabs, and erected by M. J. A. King & Co., London. The Committee's Report.
53. FIRE TESTS WITH PARTITIONS. A Partition known as the "Cunnah-Wright" Partition, by the Fireproof Partition Syndicate, Ltd., London. The Committee's Report.
54. FIRE TESTS WITH DOORS. A 2½-in. Door of Oak constructed in Three Thicknesses; a 2⅜ in. Door of Teak constructed in Three Thicknesses. Particulars of Experimental Fire Tests.
55. FIRE TESTS WITH FLOORS. A Floor of Deal Joists and Coke Breeze Concrete with Expanded Metal and Plaster Ceiling. Particulars of Experimental Fire Tests.
57. FIRE TESTS WITH FLOORS. A Floor by the Mural and Decorations Syndicate, Ltd., London, being a Double Test. The Committee's Report.
57. FIRE TESTS WITH TREATED WOOD. A Match-boarded Partition of Deal painted with Oil-colour; a Match-boarded Partition of "Non-Flammable" Deal painted with "Non-Flammable" Paint by the London Non-Flammable Wood Company, Ltd., London. The Committee's Report.
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60. FIRE TESTS WITH DOORS. Two Iron Doors. Particulars of Experimental Fire Tests.
61. FIRE TESTS WITH FLOORS. A Floor of Steel Joists with Coke Breeze Concrete. Particulars of Experimental Fire Tests.
62. FIRE TESTS WITH CEILINGS. A Wood Floor and Ceiling protected by an Additional Suspended Ceiling by Banks' Fireproof Construction Syndicate, Ltd., London. The Committee's Report.
63. FIRE TESTS WITH PARTITIONS. A Partition erected by Banks' Fireproof Construction Syndicate, Ltd., London. The Committee's Report.
64. FIRE TESTS WITH FLOORS. A Floor by Banks' Fireproof Construction Syndicate, Ltd., London. The Committee's Report.
65. The Testing Arrangements of the British Fire Prevention Committee. Some Notes with Illustrations. By ELLIS MARSLAND.
66. FIRE TESTS WITH AUTOMATIC FIRE ALARMS. Closed Circuit and Open Circuit Automatic Fire Alarms, by Pearson's Fire Alarm System, Ltd., London. The Committee's Report.
67. FIRE TESTS WITH DOORS. A Door composed of Deal and Uralite covered externally with Tinned Steel; a Door composed of Deal and Uralite covered externally with Uralite, by the British Uralite Company, Ltd., London. The Committee's Report.
68. FIRE TESTS WITH DOORS. A 1¾-in. Framed "Jarrah" Door, with 1¾-in. Solid Panels; a 1¾-in. Framed "Karri" Door, with 1¾-in. Solid Panels, by Messrs. Millars' Karri and Jarrah Forests, Ltd., London. The Committee's Report.
69. FIRE TESTS WITH DOORS. Two 2-in. Doors of Deal, hung in one opening, with a space between the Doors; two 2-in. Doors of Oak, hung in one opening, with a space between the Doors. Particulars of Experimental Fire Tests.
70. FIRE TESTS WITH DOORS. A 2-in. "Jarrah" Four-Panel Bead Flush Both Sides Door; a 2-in. "Karri" Four-Panel Bead Flush Both Sides Door, by Messrs. Millars' Karri and Jarrah Forests, Ltd., London. The Committee's Report.
71. FIRE TESTS WITH FLOORS. A Floor by Messrs. Millars' Karri and Jarrah Forests, Ltd., London. The Committee's Report.
72. FIRE TESTS WITH ROOFS. A Slated Roof and Ceiling; a Flat Roof covered with Vulcanite Roofing and Ceiling, by the Vulcanite, Ltd., London and Belfast. The Committee's Report.
73. FIRE TESTS WITH FLOORS. A Floor of Fir Supports and Oak Flooring. Particulars of Experimental Tests.
74. FIRE TESTS WITH PARTITIONS. A Partition formed with Phœnix Fire Resisting Slabs, erected by Messrs. Van der Vygh Bros., Amsterdam. The Committee's Report.
75. INTERNATIONAL FIRE PREVENTION CONGRESS, 1903, convened by the Executive of the British Fire Prevention Committee. Record of Congress Organisation. Programme and Resolution.
76. FIRE TESTS WITH DOORS. Two Doors constructed of Deal and covered externally (*i.e.*, "armoured") with Tinned Steel Plates, one hung on hinges and the other made to slide, by the Curfew Armoured Fire Door Company, Manchester. Particulars of Experimental Fire Tests.
77. FIRE TESTS WITH DOORS. Two Doors constructed of Deal and covered externally (*i.e.*, "armoured") with Tinned Steel Plates, one hung on hinges and the other made to slide, by the Curfew Armoured Fire Door Company, Manchester. The Committee's Report.
78. FIRE TESTS WITH FLOORS. A Floor of Concrete Beams reinforced with Iron Rods, by Messrs. Visintini and Weingärtner, Zürich. The Committee's Report.
79. FIRE TESTS WITH FLOORS. A Floor of Karri Wood, by Millars' and Jarrah Forests Ltd. Particulars of Experimental Fire Tests.

B. INTERNATIONAL FIRE PREVENTION CONGRESS, LONDON, 1903. The Official Report, comprising some thirty Papers, etc. With Illustrations.

C. INTERNATIONAL FIRE EXHIBITION, LONDON, 1903. The Official Record. With Illustrations. By EDWIN O. SACHS.

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OF THE

BRITISH FIRE PREVENTION COMMITTEE

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BRITISH FIRE PREVENTION COMMITTEE.—No. 81.

Edited by the Executive.

THE FIRE

AT THE

Iroquois Theatre, Chicago

30th DECEMBER, 1903

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BY

EDWIN O. SACHS

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THE VERDICT AT THE INQUEST

WITH SOME

CONSTRUCTIONAL PARTICULARS

BY

THE NATIONAL FIRE PROTECTION ASSOCIATION, U.S.A.

AND AN

INTRODUCTORY NOTE

BY

THE EXECUTIVE

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26. FIRE TESTS WITH DOORS. A 2-in. Framed Oak Door, with 2-in. Solid Panel: a 2-in. Framed Teak Door, with 2-in. Solid Panels.
27. FIRE TESTS WITH PARTITIONS. A Match-boarded Partition filled in with Silicate Cotton (Slag Wool) by Messrs. T. Anderson & Son, and Messrs. T. Broadbent & Co.
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29. FIRE TESTS WITH GLASS. Three Casements glazed by the British Luxfer Prism Syndicate, Ltd.
30. FIRE TESTS WITH GLASS. Five Skylights glazed by the British Luxfer Prism Syndicate, Ltd.
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(CHARLES ADAMI, *Assistant Secretary.*)

OBJECTS OF THE COMMITTEE:

The main objects of the Committee are :—

To direct attention to the urgent need for increased protection of life and property from fire by the adoption of preventive measures.

To use its influence in every direction towards minimising the possibilities and dangers of fire.

To bring together those scientifically interested in the subject of Fire Prevention.

To arrange periodical meetings for the discussion of practical questions bearing on the same.

To establish a reading-room, library and collections for purposes of research, and for supplying recent and authentic information on the subject of Fire Prevention.

To publish from time to time papers specially prepared for the Committee, together with records, extracts, and translations.

To undertake such independent investigations and tests of materials, methods and appliances as may be considered advisable.

The Committee's Reports on Tests with Materials, Methods of Construction, or Appliances are intended solely to state bare facts and occurrences, with tables, diagrams, or illustrations, and they are on no account to be read as expressions of opinion, criticisms, or comparisons.

NOTE

THE principal Secretary of State for Home Affairs having transmitted for the information of the British Fire Prevention Committee, various documents pertaining to the proceedings, resolutions and new theatre regulations of the Chicago City Council, arising out of the sad disaster at the Iroquois Theatre on December 30, 1903, the Executive consider that the technical particulars embodied in these papers should be circulated for the use of the membership, and they are hence embodied in this publication.

The Executive have prefaced these particulars with a descriptive report by their Chairman of the actual circumstances and occurrences of the disaster as based upon careful investigation, including the examination of a reliable eye-witness who was on the stage at the time, and who courteously allowed himself to be examined by the Executive.

They have supplemented the particulars by some technical details regarding the construction of the building, compiled by the National Fire Protection Association of the United States, and have further added extracts from the verdict of the Coroner's Jury at Chicago under whom this disaster has come for review.

The Executive have purposely not reproduced the regulations in force prior to the catastrophe, nor do they desire to make any reference to the disaster in relation to such existing regulations, or any comment on the administration of those regulations, as these matters are still *sub judice.*

In this introductory note it is not their wish to be deemed advocates of all the measures embodied in the new Chicago regulations or any other special code of building regulations.

Dealing solely with the technical aspect of regulations for safeguarding human life in theatres and other places of public assembly, the Executive consider that they should call attention to the fact that the requirements in Great Britain do not show that uniformity that is desir-

able for a class of building that is practically identical. In fact, what is considered necessary for safety in a theatre is at present so much a matter of opinion, that safeguards which relate to the preservation of property frequently receive paramount consideration, whereas those essential in the interests of protection of human life are overlooked.

It will be one of the efforts of this Executive to prepare a set of standard regulations embodying the most recent technical experience for obtaining a maximum degree of safety in theatres and places of public assembly, compatible with the practical and economic aspects of both new and existing buildings.

As the preparation of such standards will, however, involve a considerable time, the Executive will for the moment only again put on record the resolutions of the recent International Fire Prevention Congress held in London, July, 1903.

Re Theatre Safety.

THE Congress considers:

1. That the first essential for the safety of the public attending theatres is the provision of easy means of exit from the auditorium by *direct* and clear routes of exit as distinct from circuitous routes.

2. That next in importance to the provision of exits, the safety of the public requires the provision of suitable fire watches and careful fire survey with the view to the prevention of fire.

3. That the safeguard third in the scale of importance is the provision of automatic sprinklers over the stage.

4. That questions of suitable construction, fitting, and equipment, only rank after the above three primary safeguards for the protection of the public.

Re Theatre Fire Service.

THE Congress considers:

1. That with the view of furthering the prevention and extinction of fires, fire watches in theatres should be manned from the public fire service.

2. That it is desirable to either provide the necessary movable fire appliances of a theatre from the public fire service, or to have powers to enforce uniformity of pattern and quality.

3. That theatres require a duplicate water supply service.

On behalf of the Executive,

EDWIN O. SACHS, *Chairman.*

ELLIS MARSLAND, *Gen. Hon. Secretary.*

London, S.W., April, 1904.

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'e the more important by the
ipulating the scenery and to

The Chicago Theatre Fire

BY

EDWIN O. SACHS, F.S.S., ARCHITECT,

AUTHOR OF

"*Modern Opera Houses and Theatres*," "*Fires and Public Entertainments*," *etc., etc.*

The technical facts of the disaster at the Iroquois Theatre at Chicago, being of the utmost importance to the various local authorities, to the Theatre managers, and to the playgoing public, I have prepared the following notes, giving particulars as to the actual circumstances of this sad fire. I would point out that these particulars are based on indisputable and independent information from various parties of high technical knowledge, not only from the structural, but also from the Insurance and Fire Brigade point of view, and that the facts were obtained in reply to inquiries on my part, my notes being further supplemented by a careful verbal description of what occurred by an English eye-witness who was on the stage at the time of the outbreak. I have purposely avoided in any way mentioning the tenour of the local building regulations in force prior to the catastrophe, or their administration, as these are questions *sub judice*.

THE THEATRE.

The facts regarding the planning, construction, and equipment of the Iroquois Theatre, which was opened as a new building a few weeks previously, are as follows :—

(*a*) The building was very badly situated. The Theatre occupied an area of about 17,500 square feet, and com-

prised two blocks, the one containing the auditorium and the stage, the other serving as the sole approach with foyers, vestibule and main staircase. The theatre proper (*i.e.*, auditorium and stage) was situated on backland removed 90 feet back from the main thoroughfare known as Randolph Street, the centre line through the stage and auditorium running parallel with that thoroughfare, and the stage and auditorium together having a length of about 125 feet, and a width of about 90 feet. The staircase and vestibule block, which had a depth of 90 feet, had a frontage to Randolph Street of 60 feet. To the rear of the site, parallel with the main thoroughfare, was an 18 ft. alley, known as Couch Place. On all sides, the theatre proper, excepting its approach by way of the 60 ft. Randolph Street frontage and the 125 ft. boundary abutting on the alley, was built in by adjoining property, or was being built in, *i.e.*, part of the adjoining property to the back of the stage not yet having been covered in, but being in the hands of contractors.

(*b*) The building was extremely badly planned, without due regard to the requirements of rapid or even convenient, egress, without regard to the *sine qua non* of modern planning (*i.e.*, symmetry of plan in relation to the auditorium) without suitable separation of staircases for the different sections of the audience. Such staircases as existed were open staircases, *i.e.*, not self-contained, and were so badly planned that the various streams of people leaving the building met at various angles, and in some cases, even face to face. Several passages and landings formed "traps" or "*culs de sac.*" The whole audience entered, and practically left by the Randolph Street approach, passing through a series of doors. There was one common vestibule for all sections of the house by which the audience reached the stalls, and also the two tiers by way of the open staircases, overlooking the vestibule on either side.

There were emergency exits towards the alley as follows: one exit and three openings on stalls level to the alley direct, three exits each on the first and second tier to two iron outside staircases, with moveable bottom lengths. The exact stage of completion of these iron emergency staircases, and the possibility of using all the doors at the time of the fire, has not yet been definitely ascertained, but their efficiency at the time of the catastrophe is doubtful.

(*c*) The construction of the auditorium, which was a two-tier (cantilevered) house with the fronts of the tiers somewhat closer to the stage than usual, was—for a building of its size—of a superior character. The material used was, to a very considerable extent, of a fire-resisting quality. The height from stalls to ceiling was about 54 ft., and the proscenium opening was about 48 ft. wide by 34 ft. high. The total seating accommodation was 1,602, and 24 seats in boxes.

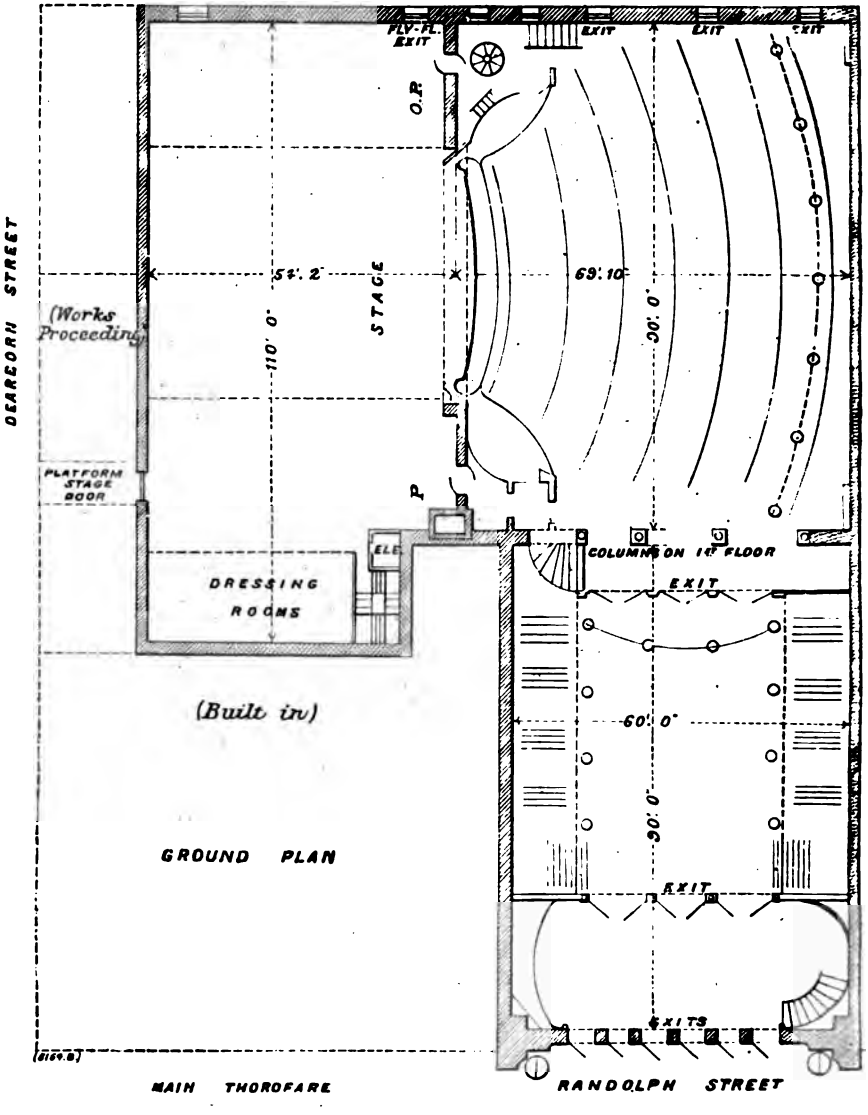
(*d*) The stage showed construction of the ordinary type, with the usual wood equipment. It was 90 ft. high from the stage level, and had a gridiron and two fly gallery levels. The stage accessories, scenery, properties, etc., were of the ordinary highly inflammable character, and had been in use for some considerable time, which involved the usual fraying and high grade of inflammability.

(*e*) The stage was intended to be separated from the auditorium in case of need by an asbestos curtain, but this appliance was of the unsuitable loose cloth drop-curtain, or so-called reefed act-drop type, temporarily mounted on wooden sheaves and worked by ordinary ropes. There is no record of its regular use or trial.

(*f*) The electrical equipment was of an average character. Many of the fittings were, however, of an inferior type, notably the electric arc lamps used on the stage, which were not properly enclosed or suitably protected.

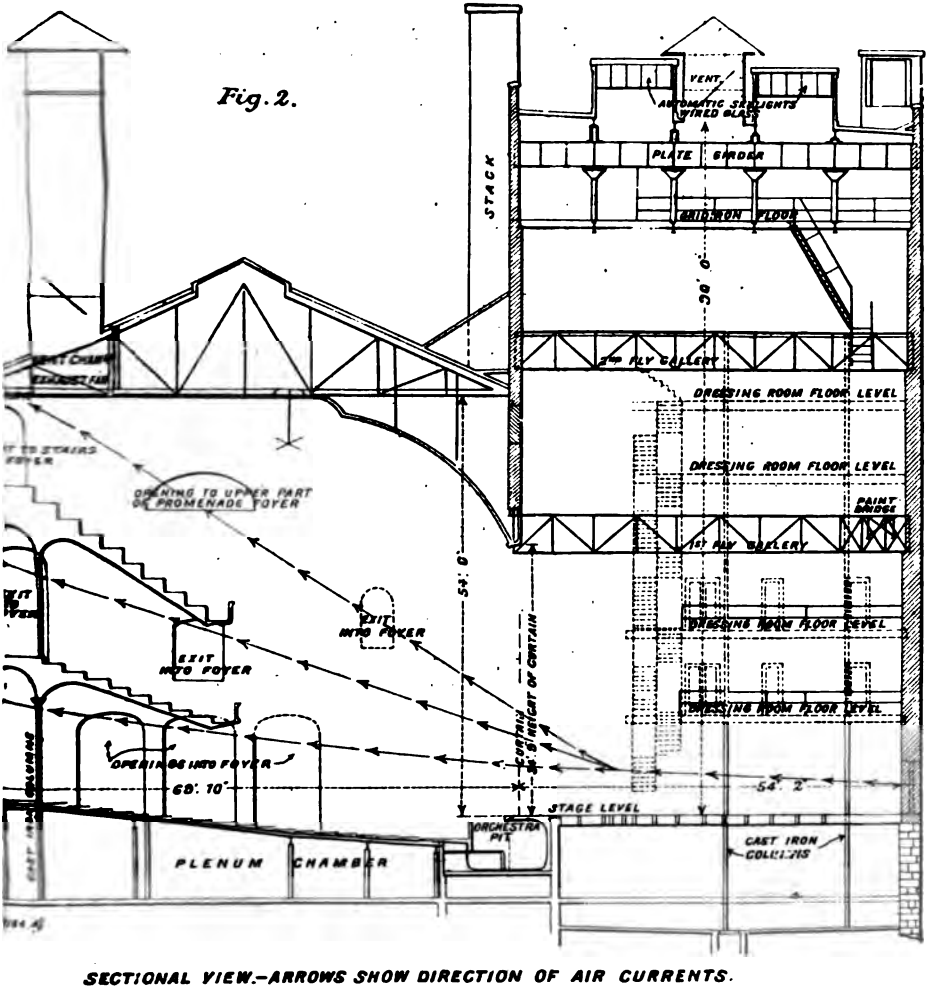
(*g*) The ventilation arrangements were incomplete, the

Fig. 3. ALLEY :— COUCH PLACE (18 Ft. wide)



SKETCH PLAN.

Fig. 2.



SECTIONAL VIEW.—ARROWS SHOW DIRECTION OF AIR CURRENTS.

ventilators over the back of the stage, if complete, would have been of insufficient area, but as a matter of fact, they were unfinished, and not equipped with proper controllers. They were blocked, *i.e.*, closed pending completion. The ventilators over the auditorium which were situated over the highest seats of the gallery were open.

(*h*) Fire appliances in the ordinary sense were non-existent in the theatre proper. There were no hydrants, buckets, hand pumps, or cutting hooks on the stage or in the auditorium. The sprinkler installation intended for the building was only in course of construction. Six patent so-called powder extinguishers were provided on the stage. There was a hydrant in the vestibule block on first floor level, and an outside vertical standpipe on the alley side of the stage, but apparently not fitted with hose. There was no fire alarm call-point in the theatre, nor direct telephonic communication with the fire brigade.

(*i*) The exits from the auditorium were not suitably indicated or illuminated, neither the ordinary exits nor emergency exits.

(*j*) There was no staff of properly trained firemen engaged in the theatre. One so-called private fireman was engaged. His credentials as to fire service experience are not yet to hand.

(*k*) There were no instructions issued to the staff as to their duties in case of panic, nor were there apparently any trial drills or fixings of fire-quarters for either stage staff or the staff in the front of the house.

(*l*) It was the custom of the stage staff (including the flymen) to leave the theatre for a considerable time while the performance of individual scenes was in progress, and thus to leave the stage mechanism practically unattended.

(*m*) A number of the dressing-rooms were situated on the Prompt side of the stage on five levels, and for the

most part overlooking the stage. These dressing-rooms were reached by an open staircase and a lift close to the proscenium wall. There was no direct exit from these rooms, the artists having to pass along the stage to the back for egress. There were additional dressing-rooms under stage and auditorium. A supplementary exit was available for part of these by way of Randolph Street.

The stage entrance in use was at the back of the stage by way of a temporary wooden bridge or footway over the adjoining property, which was in the hands of the builders, opening to part of a side thoroughfare known as Dearborn Street. The doors from stage to bridge opened outwards, those from bridge to street inwards. There was a scene dock door opening to the alley. There was an outside iron ladder on the alley side of the stage with openings to the two flies and gridiron levels.

THE FIRE.

The actual fire may be described as follows :—

The fire broke out about 3.20 p.m. during a matinee performance, and was caused by sparks (or hot particles from the carbons) from an electric arc light situated on a perch on the Prompt side, and used as a "flood" light. The spark set fire to a border during the singing of the first verse of the "Moonlight Song" in the "Bluebeard" Pantomime, and at the moment when there was a change in the lightning effects. The border caught fire at a point out of reach of the electric operator. The accident was seen by an employé on stage level, who called the fireman from the rear of the stage. The fireman rapidly mounted the electric-light perch, and tried to apply two tubes of the patent so-called powder extinguisher, but without success, the powder having no effect. The employé then called to the one flyman, who had not gone out, on

the opposite side to lower the border and drop it on the stage with a view to trampling out the fire. The instruction was misunderstood, and the flyman hastily dropped the asbestos curtain. The curtain apparently tangled owing to the man losing the "Lines," and dropped concertina fashion, stuck on one side of a projecting electric-light appliance, and then fell sloping, one portion remaining higher than the other, and neither side touching the floor. A comedian noticing the fire, came on to the front of the stage and called to the audience to keep their seats; the stage manager likewise called to the artists in the "Moonlight Song" to continue singing. The rapid spread of the fire along the border and thence to the other borders being noticed on the stage, all the artists and staff not actually in the scene apparently bolted, with the exception of the stage manager, the employé, one stage hand, and an elevator boy. The elevator boy ran the lift on the Prompt side to the various stage levels, bringing down the artists to the number of some 40 or 50, who were passed along by the employé and the other man to the temporary back stage entrance to the temporary wooden bridge, from which they escaped to the street upon the doors being pushed open (*i.e.*, inwards) by passers in the thoroughfare. The last to leave were injured or scorched. One artist was lost and succumbed. The opening of this door at the back increased the draught, and the fire spread all over the top part of the stage. The burning scenery commenced dropping heavy embers, and at this stage only did the audience realise their danger. The fire had hitherto been concealed from the majority by the partial fall of the asbestos curtain, and those in the front seats on stalls level, who saw the outbreak, had for the most part kept their seats as desired by the comedian, whose efforts had been supplemented by the doorkeepers, who had done their utmost to prevent the audience from

leaving the auditorium. Simultaneously with the embers dropping, the actors in the "Moonlight Song" ran for their lives and escaped; the stage was practically cleared of human beings at the moment when the audience realised the danger. Such of the staff as were in the lower dressing rooms escaped by passages under the auditorium, several doors having to be forced to obtain egress. The fire shot outwards from the stage into the auditorium under the curtain, and swept mainly in the direction of the open ventilator at the back of the gallery. A large number of the audience in the upper tiers were suffocated or scorched to death in their seats, hardly realising the extent of the danger. When the extent of the fire became visible, there was one fearful wave of panic, the terrors of which were accentuated by the circumstances, that parts of the auditorium were overcrowded by people occupying standing room, that the exits were not marked and were partly out of sight, and that there appears to have been some partial disarrangement of the lighting arrangements of the auditorium. The audience were impelled instinctively towards the entrances by which they had arrived, *i.e.*, the entrance towards the main thoroughfare, only a small proportion making for the emergency exits to the alley-way. From here onwards, the scenes of panic and reckless trampling are of such a terrible description that they are scarcely fitted for narration, and it need only be pointed out that the lack of exits, the planning of the staircases, and the arrangement which forced the various streams of the audience to meet at different angles, accentuated the frightful situation, and were accountable for a great number of the lives lost among those who had escaped from the auditorium proper. At this period (*i.e.*, about 15 minutes after the outbreak) the fire brigade, which had been called had already commenced to arrive in some force. They had received a "still alarm" at 3.33 o'clock,

and a bell alarm from a street box about one block distant had also reached them at 3.33½. A responsible fire brigade officer must have already reached the scene by 3.40 as his call for extra assistance rang in at 3.41.

The fire itself was rapidly extinguished; the structural damage done was slight. Regarding the contents, the stage equipment, properties and scenery were entirely destroyed, and the upholstery and decorations of the auditorium damaged, the furnishings in the front part of the stalls and in the gallery, however, alone being burnt as distinct from scorched.

As far as can be gathered the fire had already spent itself 15 minutes after the first outbreak.

The total lives at stake would appear to have been 1,830 spectators (against 1,602 + 24 for whom there was seating accommodation) and a personnel of 275. Of the audience, 571 had succumbed within a week of the outbreak of the fire, and also one member of the personnel. Of both audience and personnel there was a long list of injured; in fact, a number both of the audience and the staff lie in a critical condition.

Approximately 70 per cent. of the dead were in the gallery, and only 30 per cent. in the balcony; comparatively few on the main floor, *i.e.*, stalls level, were killed.

CONCLUSION.

The above particulars describe the circumstances and history of this terrible calamity. In every respect the circumstances and history of the fire show an unaccountable combination of defects in the planning and equipment of the theatre, untoward occurrences, blundering and misfortune, the like of which should have been an impossibility in any theatre designed, erected, and opened in the present century.

On whose shoulders the responsibility for this calamity rests is a matter *sub judice*, but it is obvious that fault must be found in more than one direction.

One bright spot alone shines out strikingly in this sad tale, and that is the pluck of the lift boy who ran his elevator to the bitter end, bravely bringing down in rapid rotation the unfortunate artists who had been penned up in the dressing rooms overlooking the stage. This act of heroism in a lift which on its last journey was actually alight, and had to be run up six storeys to bring down the members of the aerial troupe, would have done honour to any member of our fire service. For a young lift attendant, the action was beyond all praise.

As to the lessons of this fire, there are none that have not long been learnt by those versed in the subject of theatre safety in this country. But I think it my duty to reiterate that this fearful example again proves what I have so long advocated, namely, that the question of exit and straightforward planning must be given precedence to those of construction, and that the properly equipped "fire watch" and a sprinkler system should also take precedence of structural questions. But I further hold it to be an absolute essential—for old theatres and new alike—to go to the root of the initial cause of these terrible disasters by applying the principles of fire prevention to the stage, even before providing such safeguards as relate to exits or fire-extinguishing arrangements, *i.e.*, those safeguards as are only intended to meet the eventuality of a fire having actually obtained a start. The stage is generally, though not always, the scene of the outbreak. Fire prevention on the stage, as I have said before, can only be obtained by suitable incombustible construction and equipment. The scenery, properties, and furnishings of the stage must be thoroughly impregnated, so that they do not catch or spread fire caused by any untoward spark or flame, and

the construction of the stage must be of sound design and material, *i.e.*, of metallic framing and hardwood flooring, with an absence of all wood pulleys, windlasses or ordinary rope work. The highly inflammable lumbering wood stage of the last two centuries must be abolished in favour of the light and roomy metallic stage of a modern type. Given such stages, and given scenery that will not burn, the public will be able to regard a stage accident with equanimity, and have the confidence which it is impossible to attain even in the best built playhouses when the root of the evil, *i.e.*, the risk of fire on the stage, remains unconsidered, as was the case at Chicago.

The Photographs of the Interior have been courteously provided by the Editors of "Insurance Engineering" *of New York.*

The Photograph of the Exterior view has been courteously provided by the Editor of the "Sprinkler Bulletin."

all appearances these skylights were

The New Ordinances

FOR

Chicago.

Immediately after the disaster a Special Committee of the City Council was appointed for the revision of the Building Ordinances, with the result that the Council adopted New Ordinances for the class of building under consideration, namely, all buildings used as assembly halls for large gatherings of people, whether for worship, instruction, or entertainment.

ORDINANCE

GOVERNING THE CONSTRUCTION OF BUILDINGS OF CLASSES IV. AND V.

Passed by the City Council of the City of Chicago, January 18, 1904, and amended January 25, 1904.

Section 65.

Re CLASSES OF BUILDINGS:

Classes IV. and V.:—These shall include all buildings used as assembly halls for large gatherings of people, whether for purposes of worship, instruction, or entertainment.

Be it ordained by the City Council of the City of Chicago:

SECTION I. That the ordinance relating to the department of buildings and governing the erection of buildings, etc., in the City of Chicago, passed March 28, 1898, and all subsequent amendments thereto, be and the same is hereby amended as follows:

Strike out of said ordinance Sections 164 to 197, both inclusive, and said sections are hereby repealed.

Further amend said ordinance by adding thereto the following sections which shall apply only to buildings of Class IV. as defined by Section 65 of the ordinance.

"SECTION I. **Class IV. Definition of—Outside Walls of Class IV.—Structures Built Above—Walls of.**—Buildings of Class IV. shall include all buildings used as assembly halls for large gatherings of people, whether for purposes of worship, instruction or entertainment, except buildings used as public theatres where an admission fee is charged, and in which movable scenery is used.

The outside walls of all buildings of Class IV., the roof or ceiling of which is carried on trusses or girders of a span of 50 feet or more, shall have walls as follows:

If such walls are less than 25 feet high, not less than 20 inches thick.

If they are more than 25 feet and less than 45 feet high, they shall not be less than 24 inches thick.

If they are more than 45 feet and less than 60 feet high, they shall not be less than 28 inches thick.

If they are more than 60 feet and less than 75 feet high, they shall not be less than 32 inches thick.

If they are more than 75 feet and less than 90 feet high, they shall not be less than 36 inches thick.

An increase of 4 inches in thickness of such walls shall be made in all cases where they are over 100 feet long without cross walls of equal height.

For rooms less than 50 feet wide, the thickness of such walls may be reduced by 4 inches.

If one or more stories are built above the room devoted to the uses of Class IV., and such stories are carried on trusses or girders, the thickness of walls shall be increased by 4 inches for each two stories or part thereof above every such room.

If solid masonry buttresses are employed, and placed 16 feet or less apart, and extended to the foot of the trusses or girders carrying the ceiling, or if iron or steel pillars are inserted in such walls for the support of the superstructure, and at distances not more than 18 feet between centres, and if such pillars extend to and carry the superimposed trusses and girders, the thickness of such walls may be reduced in proportion to the increase of strength afforded by such buttresses or pillars, but in no case shall any such wall be less than 12 inches thick in the top story, 4 inches shall be added, going downward, for each story, for each gallery, or for each 25 feet in height of blank wall.

SECTION 2. **Pillars in Walls.**—If iron or steel pillars are introduced in said walls the brick work around the same shall be bonded into that of the connecting walls and each of such pillars shall have no less than 8 inches of brick wall around it, the brick being measured from the extreme outer dimensions of such iron or steel pillars.

SECTION 3. **Frontage of Class IV.—Seating Less than 800.** Buildings of Class IV. containing halls of a seating capacity for 800 persons or less shall have for each hall a frontage upon two public spaces, of which at least one shall be a street, and of which the other, if it is not a street shall be a public or private alley, not less than 10 feet wide, opening directly on a public street.

SECTION 4. **Frontage of Class IV.—Seating over 800.** Buildings of Class IV., containing halls of greater seating capacity than 800 shall have for each hall a facing upon three open spaces, of which at least one shall be a public street, while the two others, if not streets, shall be public or private alleys of a width of not less than 10 feet each, opening directly on a public street.

SECTION 5. **Class IV.—Construction Of.**—Buildings of Class IV. with a seating capacity of not more than 600, may be built of ordinary construction. If they have a greater seating capacity than 600 and less than 1,500 seats, they shall be built of slow burning or of mill construction. If they have a seating capacity greater than 1,500 seats they shall be built of entirely fireproof construction.

SECTION 6. **Classes I., II., or III., Built in conjunction with Class IV.**

—If buildings of Class IV. are built in conjunction with, or as a part of buildings devoted to the uses of Classes I., II., or III., then such buildings of Classes I., II., or III. shall be built of entirely fireproof construction if the connected building of Class IV. has a greater seating capacity than 1,500.

SECTION 7. **Any Building Constructed with Class IV.**—Any building higher than 60 feet and connected with or made part of any building of Class IV. shall be entirely of fireproof construction. Any building less than 60 feet in height and made part of any structure of Class IV. shall, if its case is not already covered by other provisions of this ordinance, be made of slow burning or mill construction.

SECTION 8. **Openings between Non-Fireproof Buildings.** — In all cases where fireproof construction is not used for the whole of such connected buildings, there shall be at each connecting opening double iron doors between such buildings and the building connected therewith.

SECTION 9. **Spires, Cupolas and Domes upon Houses of Worship and Instruction.** — Spires, cupolas, or domes of non-fireproof material may be erected as part of any house of public worship or instruction, if the same is used for these purposes only, and if such house of public worship or instruction is so built that it is nowhere nearer than 20 feet to any line of the lot upon which it stands, street and alley lines excepted, and such non-fireproof spires or domes may be maintained only while this intervening space of 20 feet is made and maintained as part of the grounds of the owners of such house of public worship or instruction. In case the above is complied with, such spire or dome may be built with a framework of combustible material which shall, however, be covered on the outside with porous terra cotta, hollow tile or mortar, and upon this, with a weatherproof covering of steel metal, slate or glazed tile, the same as elsewhere specified for roofs of the same type of construction.

SECTION 10. **If Conditions Violated—Dome must be Taken Down. — Roofs of Isolated Buildings of Class IV.** — If the 20 feet of vacant ground, before mentioned, as one of the conditions upon which the building of spires and domes having a combustible framework is permitted, shall be built upon, then such spire or dome shall be taken down.

The roofs of isolated buildings of Class IV. shall be constructed in the same manner as that provided for spires, domes and cupolas.

SECTION 11. **Limitations of Floor Levels of Class IV. — Auditorium Floor of Class IV.—Height above Sidewalk.**—The following exception to above limitations of floor levels in buildings of Class IV. shall be observed in all cases of new construction or alteration or improvement of existing buildings.

In buildings of Class IV. no auditorium of a larger seating capacity than 1,000 shall have the highest part of its main floor at a greater distance than 8 feet above the adjacent sidewalk grades. No room of any building of Class IV. of larger seating capacity than 500 shall be at a greater distance from the sidewalk grade than 30 feet. No room of Class IV. of larger seating capacity than 200 shall be at a higher level above the sidewalk grade than 45 feet.

The only exception to the foregoing shall be the case of rooms of buildings of Class IV. of a seating

capacity less than 500, which, in fireproof buildings, may be located in any story thereof, but in such case there shall be at least two flights of stairs from the floor in which such audience-room or auditorium of Class IV. is located, to the ground, each of which stairs shall be not less than 4 feet wide in the clear.

SECTION 12. **Class IV. Stairs Of — Stairways Of — Entrances and Exits Of.** — Stairs in buildings of Class IV. shall be in width equivalent to 18 inches for every 100 seats in such building—fractional parts of 100 being in each case counted as a full 100 seats—but no stairway in such building shall be less than 4 feet wide in the clear. All stairways shall have railings on each side thereof. No stairways shall ascend a greater height than 11 feet without a level landing, which, if its width is in the direction of the run of the stairs, shall not be less than 3 feet wide, or which, if at a turn of the stairs, shall not be of less width than of the stairs.

Distinct and separate places of exit and entrance shall be provided for each gallery above the first. A common place of exit and entrance may serve for the main floor of the auditorium and the first gallery, provided its capacity be equal to the aggregate capacity of the outlets from the main floor and the said gallery.

SECTION 13. **Class IV. — Aisles Of—Steps in Aisles Of — Passage-ways Of — Kept Unobstructed — Width of Corridors—Passages, Hallways, and Doors Of.** — Aisles in buildings of Class IV. shall be in width equal to 18 inches for every 100 seats or fractional part thereof, and the occupants of which will be required to use such aisle, but no aisles shall be less than 2 feet 6 inches wide in its narrowest part.

Steps shall be permitted in aisles only as extending from bank to bank of seats, and whenever the rise from bank to bank of seats is less than six inches the floor of the aisle shall be made as an incline plane, and where steps occur in outside aisles or corridors, they shall not be isolated but shall be grouped together, and there shall be a lamp at or near every place where there are steps in enclosing aisles or corridors.

All aisles and passage-ways in said buildings shall be kept free from camp stools, chairs, sofas, and other obstructions, and no person shall be allowed to stand in or occupy any of said aisles or passage-ways during any performance, service, exhibition, lecture, concert, ball, or any public assembly, nor shall there be any chairs, settees, or camp stools in such aisles or corridors at such times or occasions.

The width of corridors, passages, hallways and doors shall be computed in the same manner as that herein provided for stairways and aisles, excepting, however, that no corridor shall be anywhere less than 5 feet in width, and no door less than 3 feet wide.

SECTION 14. **Class IV. Emergency Exits Of.**—Emergency exits and stairways shall be provided outside of the walls of all assembly halls in buildings of Class IV. of a larger seating capacity than 800.

The aggregate width of such emergency exits which shall be provided for each floor, balcony and gallery of such building, shall be one-half of that provided for the main exits, and no emergency exit, door, or stairway shall be less than 3 feet in width.

The frame-work of such stairs shall be made of iron, and the treads of wood. Such emergency exits

shall be kept free of obstructions of all kinds, including snow.

SECTION 15. **Class IV. Doors Of, Open Outward — Walls Between Auditorium and Stage Of.** — All doors in buildings of Class IV. shall open outward.

In buildings of Class IV. there shall be a solid brick wall, of the same thickness as that called for on the outside walls, between the auditorium and stage; and in non-fireproof buildings the wall shall extend to a height of 6 feet above the roof. The main curtain opening shall have an iron or asbestos curtain, and all other openings in this wall shall have iron doors.

SECTION 16. **Structure Over Ceiling of Class IV.—Construction Of.**—If any structure is built over the ceiling or roof of any building of Class IV. the different members of the girders or trusses supporting same shall have their fireproofing double, in the manner described for pillars of fireproof buildings of Class I.

SECTION 17. **Diagram of Exits Printed on Programs.**—It shall be the duty of the owner, lessee or manager of every building of Class IV. during the performances of which programs are issued, to cause to be printed on such programs a diagram showing conspicuously the exits of such buildings.

SECTION 18. **Sign Over Exits of Class IV.** — All exits opening in buildings of Class IV. shall have the word "exit" in letters at least 6 inches high, applied to the auditorium side and to the stage side of every exit.

SECTION 19. **Fire Apparatus on Stage of Class IV.**—In all buildings of Class IV. where stationary scenery is used, of a seating capacity of 250 or more, there shall always be kept for use portable fire extinguishers or hand fire pumps on and under the stage, and also four Fire Department axes, two 25-foot hooks, two 15-foot hooks and two 10-foot hooks on each tier or floor of the stage, subject to the approval of the Fire Marshal and the Commissioner of Buildings.

SECTION 20. **License of Class IV.** —The license for each building of Class IV. shall state the number of persons it has accommodations for and no more than that number shall be allowed to enter such hall at any one time, which number shall be governed by the number of feet of exit, of the doors and passages, and shall be approved by the Commissioner of Buildings.

SECTION 21. **All Parts of Class IV. Well Lighted During Performance.**—Every portion of any building of Class IV. devoted to the uses or accommodation of the public, also all outlets leading to the streets, and including the open courts and corridors, stairways and exits shall be well and properly lighted during every performance, and the same shall remain lighted until the entire audience has left the premises.

SECTION 22. **Control of Light in Halls, Corridors and Lobbies.—Connection with Gas Mains.—Protection of Suspended and Bracket Lights.—Protection of Lights Inserted in Walls.—Protection of Foot Lights.—Construction of Border Lights.—Ducts and Shafts Conducting Heated Air from Lights.—Protection of Stage Lights.—Buildings of Class IV.** —All gas or electric lights in the halls, corridors, lobby or any other part of said buildings used by the audience, except the auditorium, shall be controlled by a separate shut-off, located in the lobby, and controlled only in that particular place. Gas mains supplying such

building shall have independent connections for the auditorium and the stage, and provision shall be made for shutting off the gas from the outside of the building. All suspended or bracket lights surrounded by glass, in the auditorium or in any part of the building shall be provided with proper wire netting underneath. No gas or electric light shall be inserted in the walls, woodwork, ceilings, or in any part of the building unless protected by fireproof materials. The footlights, in addition to the wire network, shall be protected by a strong wire guard, not less than 2 feet distant from said footlight, and the trough containing said footlights shall be formed of and be surrounded by fireproof materials. All border lights shall be constructed according to the best known methods, and subject to the approval of the Commissioner of Buildings and the Fire Marshal, and shall be suspended for ten (10) feet by wire rope. All ducts and shafts used for conducting heated air from the main chandelier, or from any other light or lights, shall be constructed of metal, and made double, with an air space between them. All stage lights, if gas, shall have strong metal wire guards or screens, not less than ten (10) inches in diameter, so constructed that any material in contact therewith shall be out of reach of the flames of stage lights, and shall be soldered to the fixtures in all cases.

SECTION 23. **Under Control of Fire Marshal and Commissioner of Buildings.**—The stand-pipes, gas-pipes, electric wires, hose, footlights, and all apparatus for the extinguishing of fire, or guarding against the same, as in this ordinance specified, shall be at all times made and kept in condition satisfactory to and under the control of the Fire Marshal and the Commissioner of Buildings of the City of Chicago.

SECTION 24. **Commissioner and Fire Marshal Empowered to Enter Class IV.**—The Commissioner of Buildings, Fire Marshal and their respective assistants shall have the right to enter any building of Class IV., and any and all parts thereof, at any reasonable time, especially when occupied by the public, in order to properly judge of and discharge their respective duties; and it shall be unlawful for any person to refuse admission to such officers or to throw obstacles in the way of such officers while engaged in the performance of their duties.

SECTION 25. **Commissioner of Buildings or Fire Marshal May Order Closed—Class IV.** The Commissioner of Buildings or Fire Marshal shall have the power to order any building of Class IV. to be closed where it is discovered that there is any violation of the provisions of this ordinance, until the same are complied with.

SECTION 26. **Mayor Revoke License of Class IV.**—Upon the report to the Mayor by the Department of Buildings, or of the Fire Marshal, that any order or requirement of this ordinance in regard to buildings of Class IV., has been violated or not complied with, in any such building, the Mayor shall revoke the license of such theatre, or place of public amusement, and cause the same to be closed.

CLASS V.

SECTION 27. **Class V. Definition Of—Outside Walls of—Structures Built Above.**

Class V. shall embrace all buildings which are used as public theatres where an admission fee is charged, and in which movable scenery is used.

The outside walls of all buildings

of Class V., the roofs or ceilings of which are carried on trusses or girders of a span of 50 feet or more, shall be as follows:

If such walls are less than 25 feet high, not less than 20 inches thick.

If they are more than 25 feet and less than 45 feet high, they shall not be less than 24 inches thick.

If they are more than 45 feet and less than 60 feet high, they shall not be less than 28 inches thick.

If they are more than 60 feet and less than 75 feet high, they shall not be less than 32 inches thick.

If they are more than 75 feet and less than 90 feet high, they shall not be less than 36 inches thick.

An increase of 4 inches in thickness of such walls shall be made in all cases where they are over 100 feet long without cross walls of equal height.

The thickness of such walls for rooms less than 50 feet wide may be reduced by 4 inches.

If one or more stories are built above the room devoted to the uses of Class V. and such stories are carried on trusses or girders, the thickness of walls shall be increased by 4 inches for each two stories or part thereof above such room.

If solid masonry buttresses are employed and placed 16 feet or less apart, and extended to the foot of the trusses or girders carrying the ceiling, or if iron or steel pillars are inserted in such walls for the support of the superstructure, and at distances not more than 18 feet between centres, and, if such pillars extend to and carry the superimposed trusses and girders, the thickness of such walls may be reduced in proportion to the increase of strength afforded by such buttresses or pillars, but in no case shall any such wall be less than 12 inches thick in the top story, and 4 inches shall be added, going downward, for each story, for each gallery, or for each 25 feet in height of blank wall.

SECTION 28. **Pillars in Walls.**—If iron or steel pillars are introduced in said walls, the brickwork around the same shall be bonded into that of the connecting wall, and each of such pillars shall have not less than 8 inches of brick wall around it, the brick being measured from the extreme outer dimensions of such iron or steel pillars.

SECTION 29. **Location — Open Spaces and Enclosed Passages.**—All buildings of Class V., hereafter erected, shall be located so that they adjoin at least two public thoroughfares. All floors, balconies and galleries of the audience-room or auditorium, including the stage of such building, shall be surrounded on four sides by either open spaces or enclosed fireproof passages, both of which shall be outside of the audience-room or auditorium, and shall open on or connect directly with such public thoroughfares, and shall at all times be kept and maintained free and clear of obstructions.

Such open space or enclosed passage-way shall not, in any event, be less than 8 feet in width clear of any and all obstructions, except stairways. Index signs reading "This Way Out" shall be placed conspicuously in such open spaces and passage-ways.

SECTION 30. **Class V.—Construction Of — Alterations in Existing Buildings.**—All buildings of Class V. hereafter erected shall be built entirely of fireproof construction.

All alterations in existing buildings of Class V. intended to make them

comply with the requirements of this ordinance may be executed in the same materials of construction at present employed in such buildings, unless otherwise distinctly provided by this ordinance.

SECTION 31. **Classes I., II., III. or IV. Built in Conjunction with Class V.—Doors for Openings between Connecting Buildings.**—If buildings of Class V. are built in conjunction with or as part of buildings devoted to the uses of Classes I., II., III., or IV., then such buildings of Classes I., II., III., or IV. shall be built entirely of fireproof construction.

In all cases where existing buildings of Class V. are built in conjunction with or as part of buildings devoted to the uses of Classes I., II., III., or IV., and where such buildings of Classes I., II., III., or IV. are not built entirely of fireproof construction, double iron doors shall be placed at each connecting opening between such buildings of Class V. and the building connected therewith.

SECTION 32. **Limitations of Floor Levels.-Exception.-Existing Theatres.**—In all buildings of Class V. hereafter constructed, the following limitations of floor levels shall govern :

In all cases where the floors of the auditorium of the buildings of Class V. are banked or stepped up, the floor level of the lowest banks shall not be above the sidewalk level.

The audience-room or auditorium in any building of Class V., now existing or which shall hereafter be constructed, containing less than 500 seats, if in a fireproof building, may be located in any story thereof, but in such case there shall be at least two separate stairways from the floor in which such audience-room or auditorium is located to the ground, each of which stairs shall not be less than 4 feet in width in the clear.

This section governing floor levels shall not apply to buildings of Class V. now existing where the lowest bank of seats of the main floor is not more than 12 feet above the street level. But such building must be fireproof and in all other respects conform to the requirements of the ordinance.

SECTION 33. **Class V. Stairs Of — Stairways Of — Entrances and Exits Of.**—Stairs in buildings of Class V. shall be in width equivalent to 20 inches for every 100 seats and fractional parts thereof in such buildings, but in no event shall any stairway in such building be less than 4 feet wide in the clear.

Each balcony and each gallery shall have immediate access to its proportionate amount of such stairway space, based upon the equivalent of 20 inches of space for every 100 seats in such balcony or gallery.

All stairways shall have handrailings on each side thereof. Stairways shall not ascend a greater height than 11 feet without a level landing, which shall not be of less width than the stairs ; no run of stairs shall consist of less than six risers between platforms, and risers shall not be placed on return platforms.

Floors at all exits shall be so designed as to be level and flush with adjacent floors and shall extend for an unbroken width of not less than 4 feet in front of each exit, and shall be 2 feet wider than such exit.

Steps shall not have a greater rise than 7 inches, treads shall not be narrower than 11 inches, and winders shall not be used on any staircase.

The main floor and also each and every balcony and gallery shall have entrance stairways from the street level, separate and distinct from every other entrance stairway.

There shall be iron stairways from the gridiron and from the fly gallery above the stage to the roof of the building or to some fireproof passage-way or exit.

All stairs on the stage side of the proscenium wall shall not be less than 2 feet 6 inches wide.

In the case of existing theatres instead of increasing the width required for aisles, exits and stairways to the basis of 20 inches per 100 seats, the owner, lessee or manager shall have the privilege of reducing the number of permanent seats until the same ratio between said width and number of seats shall be established, and if such privilege be taken advantage of it shall be the duty of the Commissioner of Buildings to make inspection and certify that said ratio actually exists before license for operation of said theatre shall be issued.

SECTION 34. **Aisles and Seating Aisles and Passage-ways Of—Kept Unobstructed. — Existing Theatres.** —Aisles and seating in buildings of Class V. shall be as follows:

The minimum width of aisles with diverging sides shall be 2 feet 8 inches at the end near the stage, and not less than 3 feet at the other end.

The minimum width of aisles with parallel sides shall be 3 feet.

Every aisle shall lead directly to an exit.

More than 10 seats in any one row between aisles shall not be lawful.

In buildings of Class V. hereafter constructed seats shall be not less than 22 inches in width measured at the top of the seat backs.

In buildings of Class V. hereafter constructed rows of seats shall be not less than 2 feet 10 inches from back to back, provided that in existing theatres a minimum width of 20 inches per seat will be permitted. And a minimum distance of 2 feet 8 inches from back to back of seats will be permitted. There shall not be any bank of seats of a greater rise than 18 inches.

All groups of seats shall be so arranged that there shall be an aisle at each side of each group.

The number of banks of seats on the "main floor" shall not exceed fifteen unless an intervening or cross-aisle or a direct exit for each aisle is provided.

The number of banks of seats in the "balcony" shall not exceed five unless an intervening or cross-aisle leading directly to an exit is provided.

The number of banks of seats in all "galleries" shall not exceed four unless an intervening or cross-aisle leading directly without turn to an exit is provided.

No foyer shall be open to the theatre proper except through the exits.

The seats on the lower floor of all theatres shall be designated as the "main floor."

Where there are balconies or galleries, the first shall be designated the "Balcony" and the second and third shall be designated respectively "First Gallery" and "Second Gallery." These designations shall be printed plainly on all tickets.

Steps shall not be permitted in aisles except as extending from bank to bank of seats, and wherever the rise from bank to bank of seats is less than 5 inches the floor of the aisles shall be made as an inclined plane, and where steps are placed in outside aisles or corridors, they shall not be isolated, but shall be grouped together, and a light shall be placed and maintained so as to clearly light every place where there are steps in enclosing aisles or corridors.

All aisles, passage-ways and corridors shall be kept free from camp stools, chairs, sofas, and other obstructions, and no persons shall be allowed to stand in or occupy any of said aisles, passage-ways, or corridors during any performance, service, exhibition, lecture, concert, or any public assemblage.

The width of corridors, passage-ways, hallways, and doors shall be computed in the same manner as that hereinbefore provided for stairways, excepting, however, that no corridor shall be anywhere less than 4 feet in width, and no door less than 3 feet wide.

All corridors, passage-ways, hallways, and stairways, leading from any balcony or gallery to any toilet-room, retiring-room, smoking-room, check-room, or private office, shall permit of free passage, without returning, to an outer exit of the building. Said corridors, passage-ways, hallways, and stairways shall be at least 3 feet in width in every part between said balcony or gallery and said outer exit, and shall be unobstructed in every part except by doors, not less than 3 feet in width, in the clear, which shall swing outward and which shall be provided with no locks or catches of any kind whatever.

The entrance doors shall be of sufficient width to accommodate the entire audience, computed on the basis of twenty (20) inches of width in the clear to each hundred (100) permanent seats or fraction thereof of the audience-room or auditorium.

No mirrors shall be so arranged as to give the appearance of a doorway, exit, hallway, or corridor, when no such doorway, exit, hallway, or corridor is really in existence at said mirrors, nor shall there be any false doors or windows giving the appearance of an opening where none really exists.

SECTION 35. **Emergency Exits, Width Of. Emergency Stairs, Width Of—Emergency Exits Inside Walls of Buildings. — Fire Escapes, Construction Of. Fire Escapes Leading to Street or Alley. — Doors open Outward.** — Emergency exits and stairways shall be provided separately for each floor, balcony, and gallery of every building of Class V. They shall be of the same size as that provided for the main exits, and no emergency exit, door, or stairway shall be less than 3 feet in width. Such emergency stairs shall be made of iron, steel, or other non-combustible material. Such emergency exits shall be kept free of all obstruction of all kinds, including snow and ice.

Such emergency exits and stairways may be built inside the walls of the building, provided they are surrounded by a fireproof partition not less than 4 inches thick separating the exits and stairways from the audience-room or auditorium.

Additional emergency exits shall be provided and located on each floor, balcony, and gallery directly and without turn in the rear of the rear bank of seats and opposite each

aisle provided on each floor, balcony, and gallery.

If such emergency exits lead outside the building, the doors leading thereto shall have metal frames filled with wire glass doors opening outward, hung from the inside corner of the jambs, and so constructed as not to project, when opened, beyond the outside face of wall and outer shutters shall not be permitted.

Wherever any such emergency stairway passes over an exit door or window or other opening, said stairway shall be completely enclosed for a space of 5 feet greater in width than said opening, by iron, steel, or other incombustible material.

All such emergency exits and stairways shall land at the ground level in a public thoroughfare or in some space that connects directly with a street or alley, and direct and immediate exit to such public thoroughfare shall not be obstructed by any door, gate, bars, or other obstruction of any character.

Every court in which there shall be a fire escape shall have direct and unobstructed access along the surface of the ground to a street, alley, or yard opening into an alley or street without entering into or passing through or over any building unless by a four-foot wide fireproof passage on the court or ground level.

All doors in all openings shall be so constructed that when opened they shall not obstruct any portion of any other doorway, opening, or passage-way.

All doors in buildings of Class V. shall open outward upon suitable hinges.

Exit doors shall not be obscured by draperies, and shall not be locked or fastened in any manner during the entire time said theatre is open to the public, but shall be so constructed and maintained that they can be opened from the interior without resistance.

SECTION 36. **Brick Wall Between Auditorium and Stage.—Steel Curtain Fireproofed on Stage Side.—No Combustible Material on Audience Side.—Plans for Curtain.—Permit From Building Department.**—In buildings of Class V. there shall be a solid brick wall of the same construction and thickness as that called for in the outside walls, between the auditorium and the stage. The main proscenium opening shall have a substantial vertically operated steel curtain, fireproofed on the stage side, which shall be raised and lowered by mechanical power and which shall be in constant use as the regular curtain and act-drop.

No combustible material other than painted decorations shall be applied to the audience side of said curtain.

Plans for said curtain shall be approved by the Building Department and a permit obtained for its erection. The Building Department shall inspect said curtain semi-annually.

All other openings in the said wall shall have iron doors, frames, and thresholds.

SECTION 37. **Construction of Stage—Fireproof Paint.**—The framing of the floor of every stage of buildings of Class V. shall be of iron or steel. The stage floor may be of wood, but shall not be less than two and three-fourths inches thick. The entire floor construction and floor of fly-galleries and rigging lofts, all railings and supports and stanchions thereon, and all sheaves,

pulleys and cables, and their supports shall be of iron or steel. All woodwook, including the under side of floor boards, and all framing for scenery used on or about the stage shall be coated with a fireproof paint, the qualities of which shall be submitted to and approved by the Commissioner of Buildings. All wood used for floor and floor supports in buildings of Class V. shall be coated on the under side with the same kind of paint. No scenery shall be used upon the stage of any building of Class V. unless such scenery shall have been treated with a paint or chemical solution which shall make it non-combustible, and which shall be approved by the Commissioner of Buildings; or if such scenery is already treated with a paint or chemical solution designed to make it non-combustible it shall not be used upon the stage of any such building until the Commissioner of Buildings, after a sufficient test of such scenery, has approved it as being non-combustible. All doorways or openings in the rear or sides of the stage shall be vestibuled or protected in a manner satisfactory to the Commissioner of Buildings so as to protect the curtain, scenery, and auditorium against draughts of air.

SECTION 38. **Structures Over Ceilings of Class V.—Construction Of.**—If any structure is built over the ceiling or roof of any building of Class V. the different members of the girders or trusses supporting same shall have their fireproofing double, in the manner described for pillars of fireproof buildings of Class I.

SECTION 39. **Vents—Size Of.—Flue Pipes.—Dampers.—Switches for Dampers.**—One or more vents suitable for the carrying away of smoke, equivalent in area to at leas one-twentieth of the area of th stage, shall be provided in connec tion with the stage, and near th top thereof, in every building o Class V.

Or a flue pipe or flue pipes of metal construction or of other non-combustible material, extending not less than fifteen (15) feet above the highest part of the roof over the stage of said building, shall be over the stage of every building of Class V., and said flue or flues shall have an area of at least one-twentieth of the total area of the stage.

All such flues or vents shall be provided with dampers which shall be made of metal, and shall be opened by a closed circuit battery, and also by a mechanical device, suitable to and approved by the Commissioner of Buildings.

Such dampers shall be controlled by two switches, one at the electrician's station on the stage, which station shall be fireproof, and the other at the city fireman's station, on the opposite side of the stage; said switches shall be located in such places on the stage as are designated by the Fire Marshal, and each shall have a sign with plain directions as to the operation of same printed thereon.

All fuse boxes shall be surrounded by two thicknesses of fireproof material, with an air space between, and no fuses shall be exposed to the air between the switchboards, and all of which shall be approved by the City Electrician.

SECTION 40. **Automatic Sprinklers—Location of.—Tank Connections.**—In every building of Class V. there shall be provided an approved system of automatic sprinklers, with approved automatic closed circuit electric devices connecting the

valves regulating the flow of water into the various sprinkler pipes with the headquarters of the City Fire Alarm Telegraph and such other place or places as the Fire Marshal shall direct, so arranged as to prevent any tampering with the system or the shutting off of the water from the sprinkler pipes without automatic notice to the Fire Department.

This system of automatic sprinklers shall be supplied with water from a tank located not less than 20 feet above the level of the highest sprinkler head in the system, and it shall be the duty of the firemen provided for in Section 45 to include in their daily report the result of an inspection to determine the sufficiency of water in this tank. Automatic sprinklers shall be placed above and below the stage; also in paint-room, store-room, property-room, scene storage-room, carpenter shop, elevator shafts, passage-ways and dressing-rooms, if they are in or connected with a building of Class V. Such tank shall not be connected with a standpipe and ladder system, but it shall be filled through a separate pipe from a fire pump, and a three-inch iron pipe shall extend from said tank to the outside of such building, with Siamese connections for fire department use. Such entire automatic sprinkler system and equipment shall be subject to the approval of the Fire Marshal of Chicago.

SECTION 41. **Fire Apparatus on Stage.—Hand Fire Pumps.—Fire Materials.**—A standpipe shall be installed on each side of the stage of all buildings of Class V., with a hose connection at each level above and below the stage, and hose connected thereto, with a self-opening valve, hose-reel device. Such standpipes shall be connected with a tank on the roof and in turn with a power pump, all of which shall be subject to the approval of the Fire Marshal. Portable fire extinguishers or hand fire pumps shall always be kept ready for use on and under the stage; in fly-galleries and in rigging loft, and in addition thereto, at least four (4) fire department axes, two (2) twenty-five (25) foot hooks, two (2) fifteen (15) foot hooks, and two (2) ten (10) foot hooks shall be kept ready for use on each tier or floor of the stage, all of which shall be subject to the approval of the Fire Marshal.

The use of ordinary hot air furnaces or stoves in any building of Class V. is strictly prohibited.

SECTION 42. **Diagram of Exits Printed on Programs.**—It shall be the duty of the owner, lessee or manager of every building of Class V., during any performance for which programs are issued, to cause to be printed on such programs, on the page opposite that upon which the cast is printed, a diagram showing conspicuously all exits of such building; and a diagram of seats of each floor of every building of said class, and the exits leading from each floor drawn to a scale of one-eighth ($\frac{1}{8}$) inch to the foot, shall be hung in a frame within two (2) feet of the ticket-seller's window of such building.

SECTION 43. **Independent Lighting System for Exits.—"Exit" and Red Light.**—All stairways or corridors throughout all buildings of Class V. shall be supplied with a supplementary lighting system of electricity, gas or sperm oil, and such system shall be independent of all other lights in such building, and shall be in operation during the entire period such theatre is open to the public and until the audience has left the building. The word "Exit" shall be in letters at least

6 inches high over the opening to every means of egress from such building, and a red light, furnished by sperm oil, shall be kept burning over said word "Exit" at every such opening, during the entire period such theatre is open to the public and until the audience has left the building.

SECTION 44. **Fire Alarm Apparatus.**—All buildings of Class V. shall be provided with an approved system of automatic or manual fire alarm telegraph apparatus, connected by the necessary wires with the headquarters of the City Fire Alarm Telegraph and such other place or places as the Fire Marshal shall direct. The number and location of the boxes and the character of the system, whether automatic or manual, or both, shall be determined by the Fire Marshal.

SECTION 45. **Employment of Firemen.—Duties of Firemen.**—It shall be the duty of the person, firm or corporation maintaining and operating a theatre in every building of Class V. to employ two or more competent, experienced firemen, who shall be detailed by the Fire Marshal; shall be in the uniform of the Chicago Fire Department; shall be on duty at each theatre during the whole time it is open to the public; shall report to and be subject to the orders of the Fire Marshal, shall see that all fire apparatus required by this ordinance is in its proper place, in proper condition ready for use, all exits unlocked during the whole time such theatre is open to the public, and all in efficient and ready working order. Said firemen and said Fire Marshal shall require a drill of the employés of said theatre for the use of all apparatus and appliances for the prevention of fire inside the building at least twice in every week, and said firemen shall report to said Fire Marshal the manner and efficiency of said drill. Said firemen shall report in writing daily to the Fire Marshal the condition of the theatre to which they are detailed, and its equipment. No fireman shall be on duty at any one theatre for a period longer than two weeks.

SECTION 46. **Licenses.**—The license for each building of Class V. shall state the number of permanent seats it contains, which number shall be governed by the foregoing provisions of this ordinance relating thereto, and no more than that number of persons shall be permitted to enter such theatre at any one time.

No license for the operation of a building of Class V. shall be issued by the officer designated by the ordinance unless the Commissioner of Buildings and the Fire Marshal shall first have certified, in writing, to such officer that such building complies with the building ordinance in every respect.

It shall be the duty of the Superintendent of Police to enforce the provisions of this section.

It shall be the duty of the person, firm, or corporation, operating a theatre in every building of Class V., to employ one policeman, detailed by the Superintendent of Police, who shall be in the uniform of the Chicago Police Department, who shall be on duty at each theatre during the whole time it is open to the public; shall report to, and be subject to, the orders of the Superintendent of Police; carry out all orders of said Superintendent; see that the provisions of this section are properly enforced, and maintain proper decorum in such buildings.

SECTION 47. **All Parts Well**

Lighted During Performances.—Every portion of buildings of Class V. devoted to the uses or accommodation of the public, also all outlets leading to the streets and including all open courts, corridors, stairways, and exits, shall be well and properly lighted during every performance, and the same shall remain lighted until the entire audience has left the premises.

SECTION 48. **Control of Lights in Halls, Corridors and Lobbies—Separate Shut-off—Connections with Gas Mains—Independent Connections—Protection of Suspended and Bracket Lights—Protection of Lights inserted in Walls—Protection of Footlights — Construction of Border Lights—Ducts and Shafts Conducting Heated Air from Lights—Gas Stage Lights to Have Metal Screens.** —All gas or electric lights in the halls, corridors, lobby, or any other part of every building of Class V. used by the audience, except the auditorium, shall be controlled by a separate shut-off, located in the lobby, and controlled only in that particular place. Gas mains supplying the building shall have independent connections for the auditorium and the stage, and provision shall be made for shutting off the gas from the outside of the building. All suspended or bracket lights surrounded by glass, in the auditorium, or in any other part of the building, shall be provided with proper wire netting underneath. No gas or electric lights shall be inserted in the walls, woodwork, ceilings, or in any part of the building, unless protected by fireproof materials. In case gas is used, the footlights, in addition to the wire network, shall be protected by a strong wire guard, not less than two feet distant from said footlights, and the trough containing said footlights shall be formed of and surrounded by fireproof materials. All border lights shall be constructed according to the best known method, and subject to the approval of the Commissioner of Buildings, and the Fire Marshal, and shall be suspended by wire rope. All ducts and shafts used for conducting heated air from the main chandelier, or from any other light or lights, shall be constructed of metal and made double, with an air-space between them. All stage lights, if gas, shall have strong metal wire guards or screens, not less than ten (10) inches in diameter, so constructed that any material in contact therewith shall be out of reach of the flames of stage lights, and shall be soldered to the fixtures in all cases.

The use of calcium lights in buildings of Class V. is strictly prohibited. All arc lights used on the stage shall at all times be subject to the approval of the City Electrician, and no arc light shall be used on any stage of buildings of Class V. unless first approved by the City Electrician.

SECTION 49. **Fire Apparatus to Be Under Control of Fire Department.**—The standpipes, automatic sprinklers, gas-pipes, electric wires, hose, footlights, fire-alarm boxes, fireproof proscenium curtain, switch-boxes, ventilators, controlling levers, axes and hooks, and all apparatus for the extinguishing of fire, or guarding against the same, as provided for by this ordinance for buildings of Class V. shall at all times be made and kept in condition satisfactory to and under control of the Fire Marshal of the City of Chicago.

SECTION 50. **Commissioner, Fire Marshal, Superintendent of Police Empowered to enter Buildings of Class V.** — The Commissioner of Buildings, Fire Marshal, the Superintendent of Police, and their respec-

tive assistants, shall have the right to enter any building of Class V. and any and all parts thereof, at any reasonable time, especially when occupied by the public, in order to examine said buildings to properly judge of the condition of the same and to discharge their respective duties, and it shall be unlawful for any person to interfere with them in the performance of their duties.

SECTION 51. **Commissioner, Fire Marshal, or Superintendent of Police shall close Buildings for Violations.** —The Commissioner of Buildings, the Fire Marshal or the Superintendent of Police shall have the power and it shall be their duty to order any building of Class V. to be closed, where it is discovered that there is any violation of the provisions of this ordinance, until the same are complied with.

SECTION 52. **Mayor shall Revoke License of Class V.** — Upon the report to the Mayor by the Department of Buildings, the Fire Marshal or the Superintendent of Police, that any requirement of this ordinance governing buildings of Class V. or that any order given by them in regard thereto has been violated, or not complied with, in any such building, the Mayor shall revoke the license of such theatre or place of public amusement, and cause the same to be closed."

SECTION 2. This ordinance shall be in force from and after its passage and due publication.

Retrospective Requirements.

The Mayor of Chicago having closed a number of theatres in which the Building Ordinances of 1898 had not been complied with, the City Council passed the following resolutions of a retrospective character in order that the theatres in question should be brought up to the requirements of the Building Ordinances as revised on January 18, 1904, in respect to a number of the safeguards promulgated :—

The following is the resolution as passed :

WHEREAS, All theatres in the City of Chicago are at the present time closed by order of his Honour, the Mayor, because of their failure to comply with the ordinances of the said City of Chicago relating to buildings ; and

WHEREAS, It is the judgment of the Special Committee appointed by his Honour, the Mayor, to revise the Building Ordinances governing theatres, that all or a portion of said theatres may be made safe for the public with certain alterations; therefore be it

Resolved, That it is the sense and

recommendation of, and it is hereby ordered by the City Council, that all persons, firms or corporations owning and operating theatres in said City of Chicago who will agree to make such alterations or changes as are necessary to comply with the Building Ordinances and the amendments thereto, passed January 18, 1904, within as short a time as possible, not later than August 1, 1904, shall be permitted to open and operate their theatres to and for the public, or such part of said theatres as an investigation will show can be opened and operated in compliance with the provisions of the said ordinance and amendments, so soon as said theatres shall comply with such of the provisions of said ordinance and amendments of January 18, 1904, as relate to fire-proof curtain, construction of stage, flue pipes or vents over stage, automatic sprinklers, fire apparatus on stage, fire alarm equipment, employment of firemen, and such additional requirements, restrictions, terms and conditions as may be imposed by the Mayor, the Commissioner of Buildings and a Sub-Committee composed of three (3) members of said Special Committee and three (3) other members of the Council to be appointed by the Mayor. Provided, in the judgment of the Mayor, Commissioner of Buildings and said Sub-Committee, the entrances, exits and aisles of such theatre are sufficient to render such theatre safe. The Mayor is also authorised to employ three practical builders or architects to consult and advise with the Sub-Committee; and provided, the said additional requirements, restrictions, terms and conditions, be reported to the City Council and approved by the said City Council.

Be it Further Resolved, That if in the judgment of the Mayor, Commissioner of Buildings and Sub-Committee any theatre now closed cannot at any time comply with the provisions of said ordinances and amendments, then and in that event the Mayor, Commissioner of Buildings, and Sub-Committee shall report to this Council the name of such theatre, and the conditions with which, in the opinion of the Mayor, Commissioner of Buildings and the Sub-Committee such theatre or theatres can not comply as required in such ordinance.

Before any theatre shall be opened under the terms of this resolution, the owners or lessees thereof, shall execute unto the City of Chicago, a good and sufficient bond in the penal sum of $25,000.00, conditioned to faithfully perform each and every the conditions and requirements of the ordinance of January 18, 1904, relating to buildings of Class V. within the time fixed in said resolution. Said bond shall be in form to be approved by the Corporation Counsel and the sureties thereon shall be approved by the Mayor.

THE IROQUOIS THEATRE, CHICAGO.

FRONT ELEVATION.

IROQUOIS THEATRE FIRE, CHICAGO.

VIEW ON STAGE.

Shows position of the Open Arc Electric Light that caused the fire by throwing sparks (i.e., *hot particles of carbon*) *on inflammable draperies hanging near by. This light was used for "flooding" the stage, with the assistance of a swinging reflector, when performers were moving about.*

The Coroner's Inquiry.

The Inquest on Mary Edna Torney and 571 others, opened on the day following the disaster by Coroner John E. Traeger and a jury of six resulted in a verdict given on Monday, January 25th, 1904, of which the following is an extract :—

"Grand drapery coming in contact with electric flood or arc light situated on iron platform on the right hand of stage, facing the auditorium."

"City laws were not complied with relating to building ordinances, regulating fire alarm boxes, fire apparatus, damper or flues on and over the stage and fly galleries."

"We also find a distinct violation of ordinance governing fire-proofing of scenery and all woodwork on or about the stage."

"Asbestos curtain totally destroyed, wholly inadequate considering the highly inflammable nature of all stage fittings, and owing to the fact that the same was hung on wooden battens."

"Building ordinances violated in closing aisles on each side of lower boxes and not having any fire apparatus, dampers, or signs designating exits on orchestra floor."

"Building ordinances violated regulating fire apparatus and signs designating exits on dress circle."

"Building ordinances violated regulating fire apparatus and signs designating exits on balcony."

"Generally, the building is constructed of the best material and well planned, with the exception of the top balcony, which was built too steep and, therefore, difficult for people to get out of, especially in case of an emergency. We also note a serious defect in the wide stairs, in extreme top east entrance, leading to the ladies' lavatory and gallery promenade, same being misleading, as many people mistook this for a regular exit and, going as far as

they could, were confronted with a locked door which led to a private stairway, preventing many from escape and causing the loss of fifty (50) to sixty (60) lives."

"We hold Will J. Davis, as president and general manager, principally responsible for the foregoing violations in the failure to see that the Iroquois Theatre was properly equipped as required by city ordinances and that his employés were not sufficiently instructed and drilled for any and all emergencies, and we, the jury, recommend that the said Will J. Davis be held to the grand jury until discharged by due course of law."

"We hold Carter H. Harrison, as mayor of the city of Chicago, responsible, as he has shown a lamentable lack of force, in his efforts to shirk responsibility, evidenced by testimony of Building Commissioner George Williams and Fire Marshal William H. Musham, as heads of the department under the said Carter H. Harrison, following this weak course, have given Chicago inefficient service, which makes such calamities as the Iroquois Theatre horror a menace until the public service is purged of incompetents, and we, the jury, recommend that the said Carter H. Harrison, be held to the grand jury until discharged by due course of law."

"We hold George Williams, as building commissioner, responsible for great neglect of his duty in allowing the Iroquois Theatre to open its doors to the public when the said theatre was incomplete and did not comply with the requirements of the building ordinances of the City of Chicago, and we, the jury, recommend that the said George Williams be held to the grand jury until discharged by due process of law."

"We hold Edward Loughlin, as building inspector, responsible for gross neglect of duty and glaring incompetency in reporting the Iroquois Theatre 'O. K.' on a most superficial inspection, and we, the jury, recommend that the said Edward Loughlin be held to the grand jury until discharged by due course of law."

"We hold William H. Musham, fire marshal, responsible for

gross neglect of duty in not enforcing the city ordinances as they relate to his department and failure to have his subordinate, William Sallers, fireman at Iroquois Theatre, report the lack of fire apparatus and appliances as required by law, and we, the jury, recommend that the said William H. Musham be held to the grand jury until discharged by due course of law."

"We hold William Sallers, as fireman of the Iroquois Theatre, for gross neglect of duty in not reporting the lack of proper fire apparatus and appliances, and we, the jury, recommend that the said William Sallers be held to the grand jury until discharged by due course of law."

"We hold William McMullen, electric light operator, for gross neglect and carelessness in performance of duty, and we, the jury, recommend that the said William McMullen be held to the grand jury until discharged by due process of law."

"We hold James E. Cummings, as stage carpenter and general superintendent of the stage, responsible for gross carelessness and neglect of duty in not equipping the stage with proper fire apparatus and appliances, and we, the jury, recommend that the said James E. Cummings be held to the grand jury until discharged by due course of law."

"From testimony presented to this jury same shows a laxity and carelessness in city officials and their routine in transacting business which calls for revision by the mayor and city council, and we, the jury, demand immediate action on the following :

"Should have classified printed lists, to be filled out by an inspector, then signed by the head of the department, before any public building can secure permanent license and record kept thereof in duplicate carbon book."

"All fire escapes should have separate passage-ways to the ground, without passing any openings in the walls. All scenery and paraphernalia of any kind kept on the stage should be absolutely fireproof."

"Asbestos curtains should be re-enforced by steel curtains and held by steel cables. There should be two electric mains entering all places of amusement, one from the front with switchboard in box office controlling entire auditorium and exits and one on the stage to be used for theatrical purposes."

"All city officials and employés should familiarise themselves with city ordinances as they relate to their respective departments, and pass a rigid and signed examination on same before they are given positions. This same rule should be made to apply to those holding office."

"All theatres and public places should be supplied with at least two city firemen, who shall be under direction of the fire department and paid for by the proprietors of said places."

"We recommend that the office and detail work of the fire department, as imposed on the fire marshal, be made a separate and distinct work from fire fighting, as it is hardly to be expected of any fire marshal to give good and efficient service in both of these branches; also a police officer in full uniform detailed in and about the said place at each and every performance."

Constructional Particulars

PRESENTED BY

THE NATIONAL FIRE PROTECTION ASSOCIATION, U.S.A.

The Association published, in January, a summary of the technical aspects of the fire for the use of its members, and the following is an extract relating to the construction of the building :—

DESCRIPTION OF BUILDING.

The building was divided into three sections, as follows :—

(1) Foyer.

One and 3 story, basement and attic. Area, 5,400 sq. ft. Roof has composition covering on concrete arches, on Tee irons, on steel I beams, on built steel girders supported on walls and cast iron columns. Independent brick bearing walls north, east and part of west varying in thickness from 2 ft. 5 in. basement to 1 ft. 9 in. at roof; part of west wall is of built steel columns and 16 in. brick anchored into party wall of building west. South or street front is ornamental stone and brick with stone columns having ornamental stone façade and cornice above. Interior wall finish of plaster on metal lath and metal furring. Floors: Roebling concrete arch on 10 in., 25 lb. steel I beams and 12 in., 31½ lb. steel girders, resting on cast iron columns varying from 10 in. to 6 in. in diameter, with metal of ½ in. to 1⅝ in. thickness. A few 15 in., 60 lb. steel I girders at framing of stairs and landings. All steel work protected (except in attic) with wire lath and concrete and plaster. Columns encased in wire lath and 2 in. concrete, then

wire lath and 4 in. concrete, with a 2 in. coat of hard plaster, which has marbleized finish. Ceilings ornamental wire lath and plaster and stucco. Attic is formed by ceiling of top floor and framing of roof, and is accessible through skylight in centre of foyer. Two main stairways, one each side of foyer first floor to second floor, two from second floor landing to third floor landing. One from third landing to gallery entrance and promenade. One stair first to second floor landing leading to boxes. One stair basement to first, partly enclosed in wire lath and plaster. One stair first to third in wire lath and plaster inclosure; open first, wood doors second and third floors, and at gallery promenade east side. One stair in front office third floor to top promenade on west side of foyer.

One ventilator in brick shaft from basement through roof, open in basement and above roof; also similar ventilator from first through roof, with openings through register face in box office first, private offices second and third and toilet room on upper promenade. Shaft for elevator to be installed extends from box office first to private office third, brick and wire lath and plaster inclosure. Foyer has unprotected communications north with auditorium, on basement, first, second and third floors and upper promenade. All walls are parapeted. This section is occupied for heating plant, toilet, smoking and dressing rooms in basement. Lobby, ticket office and main foyer on first floor. Business office and promenade second floor. Private office third floor. Toilet rooms, private bath room and gallery promenade on landings above third floor. Fifty ft. of 2½ in. rubber lined cotton hose on first connected to inside standpipe supplied from city mains.

(2) Auditorium.

Total seating capacity, 1,602—excluding twenty-four box seats. One story, basement and attic, 54 ft. 8 in. high from stage level to under side of roof trusses. Area, 6,300 sq. ft. Roof of concrete on Tee irons, steel I beams and trusses, which extend east and west and rest on independent brick, bearing walls, varying in thickness from 2 ft. 9 in. in basement to 1 ft. 5 in. above roof. Interior wall finish of plaster on metal lath on metal furring.

Floors: First, Roebling concrete arch resting on 10 in., 25 lb. and 12 in., 31½ lb. steel I beams, these in turn supported on cast iron columns in basement; seat platforms all ⅞ in. pine on 1 in. pine risers resting on concrete arches. Balcony supported by built steel girders, which heel into east wall under 1 in. steel plate and rest on cast iron columns 8 ft. from wall; girders overhang from columns forming a cantilever support; front ends of these cantilevers are bonded together with a grillage of steel straps and plates, which tie into north and south walls. Seat supports are of steel steps resting on above described girders, with a flooring of 1 in. pine, ⅛ in. asbestos and ⅞ in. maple nailed to strips of 2×4 in. wood bolted to steps. Back riser is of about No. 22 gauge sheet steel nailed to wood strips bolted to iron steps. Front of balcony has ornamental stucco finish on wire lath. Gallery is of similar construction to balcony. All steel work under balcony and gallery is protected with wire lath and plaster, cast iron columns supporting same are encased in double thickness of wire lath and plaster. Steel work in basement is protected with wire lath and concrete. All steel work in attic and under roof is unprotected. Box framing on each side is constructed of channel and Tee irons extending from floor framing to ceiling of auditorium. Wire lath and plaster and stucco work constitute finish of boxes; they have concrete arch floors with maple top finish. Main ceiling constructed of steel channels, Tee irons, wire lath and plaster, and supported by steel rods hung from roof trusses. Ceiling opening at small dome over chandelier allows air to vent through skylight in roof above. At south-west corner back of boxes there is an opening with ladder from first floor to space over ceiling. Stairway in north-west corner extending from basement to a line with gallery in brick and wire lath and plaster inclosure, openings on basement floor through wood door and direct into attic. One stair from orchestra pit into basement under stage, with wood door. The front half of main floor in centre of auditorium is pierced with numerous register openings through floor to Plenum chamber in basement; this chamber has wood doors on openings to occupied parts of basement, making an indirect communication between basement and main auditorium. Ventilating shafts of wire lath and plaster in south-east and north-east corners, with register openings on

main, balcony and gallery floors and extends into ventilating chamber in east end of attic. This chamber is inclosed by metal lath and plaster partitions and has metal flue 8 ft. in diameter extending above roof, with damper controlled from stage by wire cable. Blower in chamber for exhausting air discharges through this vent flue. Air also drawn into this chamber through openings in ceiling of auditorium. This section communicates with foyer on south in basement, main floor, balcony and gallery through unprotected openings and to stage on west through openings in basement, main floor and at first fly gallery, protected by double No. 12 iron doors, except one opening in basement to orchestra pit, which has wooden door; also through a 48 ft. 6 in. by 34 ft. 9 in. stage opening main floor, which had an asbestos curtain hung on steel cables operated by hemp rope that extended to first fly gallery, all cables run in wooden sheaves. Curtain was of asbestos cloth without reinforcement. The stage opening in brick wall is reduced in size by 3 ft. of wire lath and plaster and ornamental stucco work at sides and about 5 ft. below the 9 ton steel girder over opening. Ten openings for alley exits in north wall, 4 on main, 3 on balcony and 3 on gallery floors have iron shutters and open to iron balcony fire escapes facing unprotected openings in 6 story building across 18 ft. alley. All walls parapeted.

Building is occupied in basement by dressing and storage rooms, heating chamber and help's locker rooms. First floor for orchestra pit, main seating floor and boxes. Balcony and gallery above. Electric motor and ventilating blower in attic. No fire protection.

(3) Stage.

One story and basement. Height, 90 ft. above stage floor. This section includes stage, 2 fly galleries, 5 tiers of dressing-rooms and rigging loft. Area, 5,790 sq. ft. Concrete roof on Tee irons and steel I beams stooled on 5 heavy, built steel girders that also support rigging loft and rest on brick piers 2 ft. 5 in. thick west and 1 ft. 9 in. brick proscenium wall east. Walls plain brick, varying from 2 ft. 9 in. in basement to 1 ft. 5 in. at roof line, except west wall has 5 piers 2 ft. 6 in. wide by 2 ft. 5 in. thick under girders. Proscenium wall east is similar in thickness, except

that directly over opening at stage it has a 9 ton plate girder supporting brick wall above; this part of wall is reinforced by a 1 ft. 9 in. brick relieving arch, spanning opening, which is 48 ft. 6 in. wide by 34 ft. 9 in. high. Supports for fly galleries at north and south sides rest in east and west walls and on bridge-truss girders, which also carry "tie-off" rails. Five supplementary floors in south end, extending from 12 ft. above stage level to 5 ft. above second fly gallery, have Roebling floor arches supported on 10 in., 25 lb. steel I beams. Centre of stage floor, 48 by 52 ft., is of 4 in. pine resting on wooden joists and unprotected steel girders in basement. The framing of gridiron is of steel girders and floor is of 2 in. by 1 in. by 1 in. inverted channel irons, spaced 1½ in. apart. Interior partitions are of metal studs, wire lath and plaster in basement and inclosing dressing-rooms above. One open elevator basement to above second fly gallery. One stairway basement to second fly gallery, partly in wire lath and plaster; open stair second fly gallery to gridiron. One trap in wooden part of stage, first to basement. One trunk hoist first to basement (floored over at present). Paint bridge is of steel construction, consisting of two bridge trusses and iron floor. Paint frame was of wood, skeleton form, operated on west wall. "Tie off" rails on fly floors are of cast iron. Belaying pins are of cast iron. Girders under stage and supplementary floors have unprotected cast iron column supports, all steel work in supplementary floors protected except lower flanges of beams. All other steel work on stage unprotected, except 9 ton plate girder in proscenium wall has wire lath and plaster inclosure. Two shafts in brick and lath and plaster at south-west and north-west corners to ventilate basement and dressing-rooms. Two metal frame, wired glass skylights, 10 × 25 ft. each, were to have been arranged to open automatically. One metal ventilator, 66 sq. ft. over centre of stage, with metal damper, was to have been constructed to open from Prompt stand. Prompt stand has marble and slate switchboard and metal rack for stage dimmer. Wiring mostly in iron conduits. Proscenium light boards at each side of stage in metal frames were hinged so that when in use they swung out in the path of the asbestos curtain. Heat was from steampipes extending vertically 40 ft. above stage floor; these were to have been protected by iron guards every 6 ft. to prevent

scenery being piled against them. There were six tubes of Kilfyre on stage. Outside fire escapes and standpipe on north, with window openings on each fly gallery. Stage was occupied in basement by dressing rooms, employés' locker rooms, electrician's room and general baggage store-room. First or stage floor contained temporary property room, prompt and electrician's stand and storage of some scenery in use. Temporary carpenter shop on second fly gallery. Electric motor just under roof for elevator.

In General.

The building was incomplete in a number of items. The smoke damper and sliding skylights on roof over stage had not been connected up for control from within the building. Iron sheave blocks had not been provided for asbestos curtain. Iron doors had not been placed on basement opening through proscenium wall to orchestra pit. Exit signs had not been placed. No automatic sprinklers on stage. No fire alarm box on premises. No approved fire equipment on stage.

The furnishings of the theatre, consisting of carpets, seats, draperies, scenery, properties and costumes, were all of combustible material. Make-up tables in dressing-rooms are of galvanised iron and angle iron frames. Flooring for seat runs in auditorium and two balconies are of wood, with air space below.

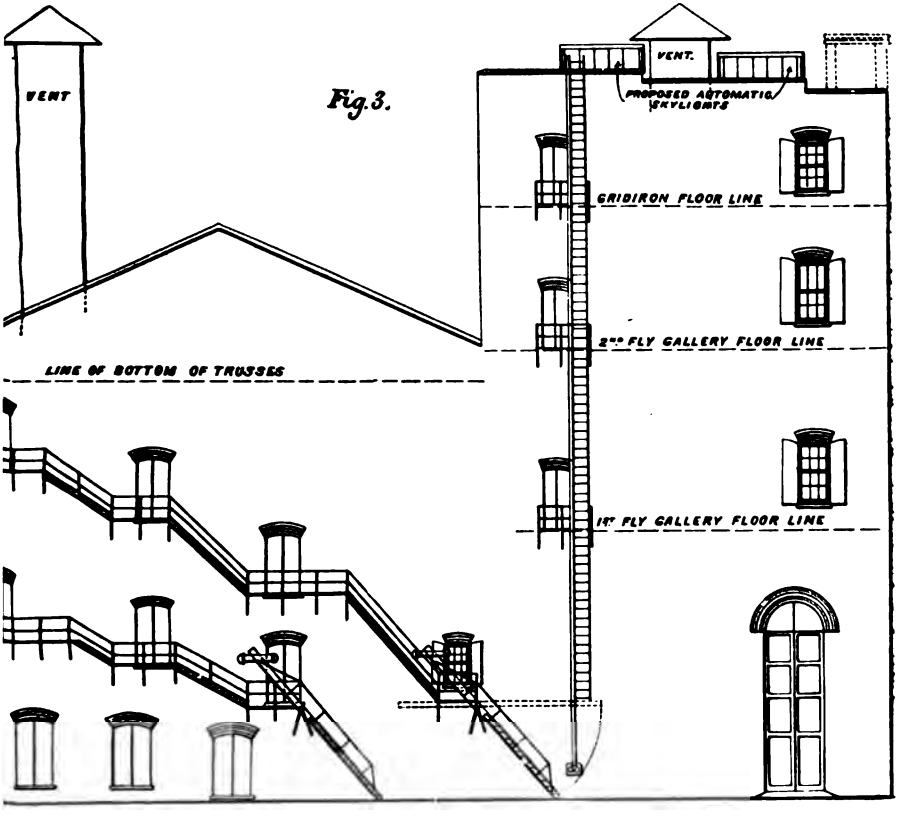


Fig. 3.

REAR ELEVATION, SHOWING EMERGENCY EXITS.

List of the British Fire Prevention Committee's Publications—*Contd.*

49. FIRE TESTS WITH DOORS. A 2⅛-in. Door of Archangel Deal constructed in Three Thicknesses; a 2⅛-in. Door of Quebec Pine constructed in Three Thicknesses. Particulars of Experimental Fire Tests.
50. FIRE TESTS WITH DOORS. A 2⅛-in. Door of Archangel Deal constructed in Three Thicknesses; a 1⅜-in. Door of Teak, Flush Panelling on each side, the Panels being in Two Thicknesses. Particulars of Experimental Fire Tests.
51. FIRE TESTS WITH FIRE-RESISTING CURTAINS. Two Fire Blinds, known as the "Williams" Fire Blinds, installed by G. A. Williams & Son, Bayswater, London. The Committee's Report
52. FIRE TESTS WITH PARTITIONS. A Partition formed with "Mack's" Patent Slabs, and erected by M. J. A. King & Co., London. The Committee's Report.
53. FIRE TESTS WITH PARTITIONS. A Partition known as the "Cunnah-Wright" Partition, by the Fireproof Partition Syndicate, Ltd., London. The Committee's Report.
54. FIRE TESTS WITH DOORS. A 2⅞-in. Door of Oak constructed in Three Thicknesses; a 2⅜ in. Door of Teak constructed in Three Thicknesses. Particulars of Experimental Fire Tests.
55. FIRE TESTS WITH FLOORS. A Floor of Deal Joists and Coke Breeze Concrete with Expanded Metal and Plaster Ceiling. Particulars of Experimental Fire Tests.
56. FIRE TESTS WITH FLOORS. A Floor by the Mural and Decorations Syndicate, Ltd., London, being a Double Test. The Committee's Report.
57. FIRE TESTS WITH TREATED WOOD. A Match-boarded Partition of Deal painted with Oil-colour; a Match-boarded Partition of "Non-Flammable" Deal painted with "Non-Flammable" Paint by the London Non-Flammable Wood Company, Ltd., London. The Committee's Report.
58. FIRE TESTS WITH PARTITIONS. A Partition known as the "Cunnah-Wright" Partition, by the Fireproof Partition Syndicate, Ltd., London. The Committee's Report.
59. FIRE TESTS WITH DOORS. An Ordinary 4-Panelled Deal Door; an ordinary Ledged Deal Door. Particulars of Experimental Fire Tests.
60. FIRE TESTS WITH DOORS. Two Iron Doors. Particulars of Experimental Fire Tests.
61. FIRE TESTS WITH FLOORS. A Floor of Steel Joists with Coke Breeze Concrete. Particulars of Experimental Fire Tests.
62. FIRE TESTS WITH CEILINGS. A Wood Floor and Ceiling protected by an Additional Suspended Ceiling by Banks' Fireproof Construction Syndicate, Ltd., London. The Committee's Report.
63. FIRE TESTS WITH PARTITIONS. A Partition erected by Banks' Fireproof Construction Syndicate, Ltd., London. The Committee's Report.
64. FIRE TESTS WITH FLOORS. A Floor by Banks' Fireproof Construction Syndicate, Ltd., London. The Committee's Report.
65. The Testing Arrangements of the British Fire Prevention Committee. Some Notes with Illustrations. By ELLIS MARSLAND.
66. FIRE TESTS WITH AUTOMATIC FIRE ALARMS. Closed Circuit and Open Circuit Automatic Fire Alarms, by Pearson's Fire Alarm System, Ltd., London. The Committee's Report.
67. FIRE TESTS WITH DOORS. A Door composed of Deal and Uralite covered externally with Tinned Steel; a Door composed of Deal and Uralite covered externally with Uralite, by the British Uralite Company, Ltd., London. The Committee's Report.
68. FIRE TESTS WITH DOORS. A 1¾-in. Framed "Jarrah" Door, with 1¾-in. Solid Panels; a 1¾-in. Framed "Karri" Door, with 1¾-in. Solid Panels, by Messrs. Millars' Karri and Jarrah Forests, Ltd., London. The Committee's Report.
69. FIRE TESTS WITH DOORS. Two 2-in. Doors of Deal, hung in one opening with a space between the Doors; two 2-in. Doors of Oak, hung in one opening, with a space between the Doors. Particulars of Experimental Fire Tests.
70. FIRE TESTS WITH DOORS. A 2-in. "Jarrah" Four-Panel Bead Flush Both Sides Door; a 2-in. "Karri" Four-Panel Bead Flush Both Sides Door, by Messrs. Millars' Karri and Jarrah Forests, Ltd., London. The Committee's Report.
71. FIRE TESTS WITH FLOORS. A Floor by Messrs. Millars' Karri and Jarrah Forests, Ltd., London. The Committee's Report.
72. FIRE TESTS WITH ROOFS. A Slated Roof and Ceiling; a Flat Roof covered with Vulcanite Roofing and Ceiling, by the Vulcanite Ltd., London and Belfast. The Committee's Report.
73. FIRE TESTS WITH FLOORS. A Floor of Fir Supports and Oak Flooring. Particulars of Experimental Tests.
74. FIRE TESTS WITH PARTITIONS. A Partition formed with Phœnix Fire-Resisting Slabs, erected by Messrs. Van der Vlugt Bros., Amsterdam. The Committee's Report.
75. INTERNATIONAL FIRE PREVENTION CONGRESS, 1903, convened by the Executive of the British Fire Prevention Committee. Record of Congress Organisation, Programme and Resolution.
76. FIRE TESTS WITH DOORS. Two Doors constructed of Deal and covered externally (*i.e.*, "armoured") with Tinned Steel Plates, one hung on hinges and the other made to slide, by the Curfew Armoured Fire Door Company, Manchester. Particulars of Experimental Fire Tests.
77. FIRE TESTS WITH DOORS. Two Doors constructed of Deal and covered externally (*i.e.*, "armoured") with Tinned Steel Plates, one hung on hinges and the other made to slide, by the Curfew Armoured Fire Door Company, Manchester. The Committee's Report.
78. FIRE TESTS WITH FLOORS. A Floor of Concrete Beams reinforced with Iron Rods, by Messrs. Visintini and Weingärtner, Zurich. The Committee's Report.
79. FIRE TESTS WITH FLOORS. A Floor of Karri Wood, by Millars' and Jarrah Forests Ltd. Particulars of Experimental Fire Tests.

B. INTERNATIONAL FIRE PREVENTION CONGRESS, LONDON, 1903. The Official Report, comprising some thirty Papers, etc. With Illustrations.

C. INTERNATIONAL FIRE EXHIBITION, LONDON, 1903. The Official Record. With Illustrations. By EDWIN O. SACHS.

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NOTE.

The Standards of Fire Resistance, which were originally prepared in the form of Suggestions by the British Fire Prevention Committee and afterwards adopted as Universal Standards by the International Fire Prevention Congress of July, 1903, are being accorded such importance in different countries that the Executive have deemed it necessary to publish them, with an authorised translation in French and German, and with the measurements, weights and temperatures common to this country transcribed into metric ones.

It will have been observed that since the Congress above referred to, and in accordance with one of the resolutions arrived at on that occasion, the reports on tests issued by this Committee embody the metric equivalents wherever practicable. But as so many reports had been issued prior to the adoption of this policy, the Executive have deemed it appropriate to append some tables which should be found useful by students abroad who wish quickly to find metric figures in place of the British ones constantly recurring in these publications.

The importance of this universal standard need not be dwelt upon on this occasion except to say that, if anything, the recent fires both in Great Britain, on the Continent and in America, continue to point to the urgency of systematic efforts on an identical basis in all countries to combat the growing evil of fatal fires. The standardisation of the available materials and systems of construction that will resist fire should greatly facilitate the adoption of suitable precautionary measures.

In the compilation of this Publication, the Executive are much indebted to Chief Officers Dittman, of Bremen, and Welsch, of Ghent; and further, in respect to the conversion of the figures, to Mr. Max Clarke, F.R.I.B.A.

EDWIN O. SACHS.

LONDON, *July 16th*, 1904.

THE GENERAL ARRANGEMENTS FOR TESTS.

(*MEMORANDUM.*)

THE purpose of the tests undertaken by the British Fire Prevention Committee is to obtain reliable data as to the exact fire-resistance of the various materials, systems of construction, or appliances used in building practice.

The tests are of an entirely independent character, arranged on scientific lines, but with full consideration for the practical purpose in view. Absolute reliability is assured, records being mostly taken automatically, or by photography, and the temperatures being easily regulated by the application of gas.

All reports on tests solely state the bare facts and occurrences, with tables, diagrams, and illustrations, and on no account are reports to be taken as including expressions of opinion, nor should any expression be read as a comparison or criticism.

The general arrangement and direction of the tests are in the hands of the Executive, who act in accordance with certain principles laid down after careful study and experiment. The official tests are attended by the members of the Council and the members of the Committee in rotation.

As to the Committee's present Testing Station, it comprises a house, standing in its own grounds, near Royal Oak Station, and backing on to the Great Western Railway. The principal building is used for Committee Rooms and laboratory purposes, whilst the gardens are utilised for so-called "full-size" tests.

As to the financial aspect of the station, the establishment expenses are being met by a special subscription. As far as the funds of the committee permit, investigations and experimental tests with ordinary (*i.e.*, not patented) forms of construction are undertaken from time to time and duly reported on. Official tests with patented materials, makers' systems, etc., etc., are subject to a scale of charges, but these charges are so figured as to only just cover the actual cost. The Testing Station is also open to members for such private research work or tests they may desire to undertake.

The services of the members participating in the management of the station, conducting or attending tests, are given entirely gratuitously.

For the Executive,

EDWIN O. SACHS, *Chairman.*

THE
STANDARDS OF FIRE RESISTANCE
OF THE
BRITISH FIRE PREVENTION COMMITTEE
AS ADOPTED TO SERVE AS
UNIVERSAL STANDARDS
AT THE
INTERNATIONAL FIRE PREVENTION CONGRESS,
LONDON, 1903.

The following were the Congress Resolutions referring to the subject:—

Re the term "Fireproof."

THE Congress having given their consideration to the constant misuse of the term "fireproof," and its indiscriminate and unsuitable application to many building materials and systems in use, have come to the conclusion that the avoidance of this term in the general business and technical vocabulary is essential.

Re the term "Fire-resisting."

THE Congress considers the term "fire-resisting" more applicable for general use, and that it more correctly describes the varying qualities of the different materials and systems of construction intended to resist the effect of fire for shorter or longer periods, at high or low temperatures, as the case may be; and it advocates the general adoption of this term in the place of the term "fireproof."

Re Standards of Fire Resistance.

THE Congress confirms the British Fire Prevention Committee's proposed standards of fire-resistance, and hereby resolves that the universal standards of fire-resistance shall in future be:—

1. *Temporary protection;*
2. *Partial protection;*
3. *Full protection;*

in accordance with the Committee's schedule.

The executive of the British Fire Prevention Committee having given their careful consideration to the common misuse of the term "fireproof," now indiscriminately and often most unsuitably applied to many

building materials and systems of building construction in use in Great Britain, have come to the conclusion that the avoidance of this term in general business, technical, and legislative vocabulary is essential.

The executive consider the term "fire-resisting" more applicable for general use, and that it more correctly describes the varying qualities of different materials and systems of construction intended to resist the effect of fire for shorter or longer periods, at high or low temperatures, as the case may be, and they advocate the general adoption of this term in place of "fireproof."

Further, the executive, fully realising the great variations in the fire-resisting qualities of materials and systems of construction, consider that the public, the professions concerned, and likewise the authorities controlling building operations, should clearly discriminate between the amount of protection obtainable or, in fact, requisite for different classes of property. For instance, the city warehouse filled with highly inflammable goods of great weight requires very different protection from the tenement house of the suburbs.

The executive are desirous of discriminating between fire-resisting materials and systems of construction affording *temporary* protection, *partial* protection, and *full* protection against fire, and to classify all building materials and systems of construction under these three headings. The exact and definite limit of these three classes is based on the experience obtained from numerous investigations and tests, combined with the experience obtained from actual fires, and after due consideration of the limitations of building practice and the question of cost.

The executive's minimum requirements of fire-resistance for building materials or systems of construction will be seen from the standard tables appended for—

I. Fire-resisting floors and ceilings,

II. Fire-resisting partitions,

III. Fire-resisting doors,

but they could be popularly summarised as follows :—

(*a*) That temporary protection implies resistance against fire for at least three-quarters of an hour.

(*b*) That partial protection implies resistance against a fierce fire for at least one hour and a-half.

PROPOSITIONS

DU

BRITISH FIRE PREVENTION COMMITTEE

RELATIVES À LA RÉSISTANCE AU FEU DES MATÉRIAUX DE CONSTRUCTION.

ADOPTÉES COMME TYPES UNIVERSELS

AU

CONGRÈS INTERNATIONAL DES MESURES PRÉVENTIVES TENU À LONDRES EN 1903.

RÉSOLUTIONS DU CONGRES.

L'expression "*à l'épreuve du Feu.*"

LE Congrès ayant délibéré sur l'abus universel de l'expression "à l'épreuve du feu" (fire-proof) et sur son emploi injustifié pour désigner beaucoup de matériaux et systèmes employés dans la construction, émet le vœu que cette expression soit rayée du vocabulaire commercial et professionnel.

L'expression "*Résistant au Feu.*"

LE Congrès est d'avis que l'expression "résistant au feu" (fire-resisting) convient généralement mieux pour définir plus exactement cette qualité spéciale des matériaux et systèmes de construction de résister plus ou moins longtemps à l'effet d'un feu à haute ou basse température, suivant les circonstances.

Classes *de Résistance au Feu.*

LE Congrès approuve et adopte le classement des systèmes de construction résistant au feu proposé par le "British Fire Prevention Committee" qui tient compte des degrés de résistance au feu des matériaux pour assurer:—

1° *Une protection temporaire;*
2° *Une protection partielle;*
3° *Une protection entière.*

Le comité exécutif du British Fire Prevention Committee tenant compte de l'abus universel de l'expression à "l'épreuve du feu" et de son application et emploi injustifiés pour désigner beaucoup de matériaux et

systèmes de construction employés dans la Grande Bretagne, a conclu que cette expression soit être rayée du vocabulaire commercial, professionnel et législatif.

Le comité exécutif est d'avis que l'expression "résistant au feu" (fire-resisting) convient généralement mieux pour définir plus exactement cette qualité spéciale des matériaux et systèmes de construction de résister plus ou moins longtemps à l'effet d'un feu, à haute ou basse température suivant les circonstances et il émet le voeu de voir adopter généralement cette expression à la place de "fire-proof."

Enfin le comité exécutif tenant compte des nombreuses variations que subissent les matériaux et les systèmes de construction résistant au feu considère que le public, les personnes que la chose concerne, ainsi que les autorités chargées de contrôler les opérations de la bâtisse puissent discerner le degré de protection qu'on peut obtenir ou plutôt indispensable aux différentes classes d'immeubles. Par exemple, un entrepôt communal, rempli de matières hautement inflammables, nécessite une protection qui diffère essentiellement de celle d'un immeuble de la banlieue. Le comité exécutif estime qu'il faut pouvoir discerner entre les matériaux et systèmes de construction résistant au feu donnant une protection temporaire, partielle ou entière et ranger tous les matériaux et systèmes employés dans ces trois catégories.

La limite exacte et définitive de ces trois classes sera basée d'après les résultats obtenus à de nombreuses investigations et expériences, ainsi qu'aux incendies, en tenant compte de la destination de l'immeuble et des frais de construction.

Les exigences minima du comité exécutif relatives aux matériaux et systèmes de construction résistant au feu seront conformes aux tableaux-types ci-après dressés pour :

1° Les planchers et les plafonds ;

2° Les cloisons ;

3° Les portes.

Ce qui revient à dire en d'autres termes que :

A) Une protection temporaire nécessite une résistance au feu de $\frac{3}{4}$ d'heure au moins.

B) Une protection partielle doit résister à un violent feu pendant $1\frac{1}{2}$ heure au moins.

C) Une protection entière est considérée comme acquise quand la matière à soumettre à un feu violent résiste au moins pendant 2½ heures.

Les intéressés trouveront dans les tableaux ci-après tous les renseignements relatifs aux températures minima réelles, à l'épaisseur, à la charge, à la durée de la projection de l'eau, mais pour le discernement des masses, que le comité exécutif désire encourager, le temps stipulé seul sera pris en considération.

Il est désirable que ces types soient universellement acceptés et que le même mode d'appréciation soit en usage à l'avenir dans tous les pays ; les bases d'adoption de cette méthode universelle peuvent être considérées comme établies.

Pour le comité exécutif du British Fire Prevention Committee,

EDWIN O. SACHS, *Président.*
ELLIS MARSLAND, *Sécretaire.*

TABLEAU-TYPE DE LA RESISTANCE AU FEU DES PLANCHERS.

CLASSIFICATION.	Subdivision.	Durée minimum de l'épreuve.	Température minimum.	Charge par m.c. de superficie.	Superficie minimum à soumettre à l'épreuve.	Durée minimum de projection d'eau.
Protection temporaire	Classe A	45 min.	815·5° C.	Facultatif	9·290 m.c.	2 min.
	Classe B	60 min.	815·5° C.	Facultatif	18·580 m.c	2 min.
Protection partielle	Classe A	90 min.	982·2° C.	546·852 kg.	9·290 m.c.	2 min.
	Classe B	120 min.	982·2° C	820·278 kg.	18·580 m.c.	2 min.
Protection entière	Classe A	150 min.	982·2° C	1093·700 kg.	9·290 m c.	2 min.
	Classe B	240 min	982·2° C.	1367·130 kg.	18·580 m.c	5 min.

* *

TABLEAU-TYPE DE LA RÉSISTANCE AU FEU DES CLOISONS.

CLASSIFICATION.	Subdivision.	Durée minimum de l'épreuve.	Température minimum.	Epaisseur des matériaux.	Superficie minimum à soumettre à l'épreuve.	Durée minimum de la projection d'eau.
Protection temporaire	Classe A	45 min.	815·5° C.	·051 m. et moins	7·432 m.c.	2 min.
	Classe B	60 min.	815·5° C.	Facultatif	7·432 m.c.	2 min.
Protection partielle ...	Classe A	90 min.	982·2° C.	·063 m. et moins	7·432 m.c.	2 min.
	Classe B	120 min.	982·2° C.	Facultatif	7·432 m.c.	2 min.
Protection entière ...	Classe A	150 min.	982·2° C.	·063 m. et moins	7·432 m.c.	2 min.
	Classe B	240 min.	982·2° C.	Facultatif	7·432 m.c.	5 min.

TABLEAU-TYPE DE LA RÉSISTANCE AU FEU POUR DE SIMPLES PORTES OU SANS CHAMBRANLE.

CLASSIFICATION.	Subdivision.	Durée minimum de l'épreuve.	Température minimum.	Epaisseur des matériaux.	Superficie minimum à soumettre à l'épreuve.	Durée minimum de la projection d'eau.
Protection temporaire	Classe A	45 min.	815·5° C.	·051 m. et moins	1·858 m.c.	2 min.
	Classe B	60 min.	815·5° C.	Facultatif	1·858 m.c.	2 min.
Protection partielle ...	Classe A	90 min.	982·2° C.	·063 m. et moins	1·858 m.c.	2 min.
	Classe B	120 min.	982·2° C.	Facultatif	1·858 m.c.	2 min.
Protection entière ...	Classe A	150 min.	982·2° C.	·013 m. et moins	2·322 m.c.	2 min.
	Classe B	240 min.	982·2° C.	Facultatif	2·322 m.c.	5 min.

DIE FEUERSICHERHEITS NORMEN

DES

BRITISH FIRE PREVENTION COMMITTEE

ANGENOMMEN ALS

ALLGEMEINE NORMEN VOM INTERNATIONALEN FEUER-VERHÜTUNGS CONGRESS, LONDON, 1903.

Die folgenden Resolutionen sind die Congress-Beschlüsse:—

Der Begriff "*Feuerfest.*"

DER Kongress ist der Meinung, dass die Anwendung des Begriffes "feuerfest" (fire-proof) in Gross Britannien oft nicht die richtige Bezeichnung für Baumaterialien und Bauconstructionen ist, und hält es für nötig, dass die Bezeichnung "feuerfest" (fire-proof) im geschäftlichen und technischen Verkehr nicht mehr gebraucht wird.

Der Begriff "*Feuersicher.*"

DER Kongress hält den Begriff "feuersicher" (fire-resisting) mehr der Wirklichkeit der Verhältnisse entsprechend und empfiehlt das Wort "feuersicher" (fire-resisting) an Stelle des Wortes "feuerfest" zu gebrauchen.

Klassen *der Feuersicherheit.*

DER Kongress ist mit der Einteilung in verschiedene Klassen der Feuersicherheit, wie sie von dem British Fire Prevention Committee vorgeschlagen sind, einverstanden, und bestimmt, dass man in Zukunft unterscheiden möge zwischen:

Zeitweiser
Teilweiser } *Feuersicherheit.*
Voller

Der Geschäftsausschuss des British Fire Prevention Committee hat dem allgemein verbreiteten Missbrauch der Bezeichnung *feuerfest,* die zur Zeit ohne Unterschied und oft ohne Berechtigung vielen Baumaterialien und Bauconstruktionen beigelegt wird, nachgeforscht und ist

zu dem Schlusse gekommen, dass es notwendig ist, diese Bezeichnung aus dem geschäftlichen, technischen und juristichen Sprachgebrauch zu verbannen.

Der Geschäftsausschuss hält die Bezeichnung *feuersicher* für empfehlenswerter und besser geeignet, die Fähigkeit der verschiedenen Baumaterialien und Construktionen zu kennzeichnen dem Feuer für kürzere oder längere Zeit bei hohen oder niederen Temparaturen Widerstand zu leisten. Er schlägt daher vor statt *feuerfest* die Bezeichnung *feuersicher* anzuwenden.

Ferner ist der Geschäftsausschuss in Anbetracht der grossen Verschiedenheit der Feuersicherheit der Baumaterialien und Construktionen der Meinung, dass das Publikum, die Interessentenkreise und die Behörden genau unterscheiden müssen zwischen dem für verschiedene Arten von Gebäuden erforderlichen Grad des Feuerschutzes. Es bedarf doch z. B. ein mit feuergefährlichen Gütern angefülltes Warenhaus eines ganz anderen Feuerschutzes, als ein kleines Mietshaus in der Vorstadt.

Der Geschäftsausschuss will unterschieden sehen bei den feuersicheren Materialien und Bauconstruktionen, zwischen solchen, die *zeitweisen*, die *teilweisen* oder *vollen Schutz* gegen Feuer bieten und möchte nach diesen 3 Graden alle Baumaterialien und Construktionen klassifizieren. Die genaue Einteilung in die Klassen erfolgt nach dem Ergebnis zahlreicher Untersuchungen und Proben, sowie nach den bei Bränden gesammelten Erfahrungen unter sorgfältiger Berücksichtigung der dem praktischen Bauwesen gezogenen Schranken und der Kostenfrage.

Die vom Geschäftsausschuss vorgeschlagenen Mindestforderungen an die Feuersicherheit der Baumaterialien oder Construktionen sind in den beigefütgen Tabellen enthalten für:

I. Feuersichere Fussböden und Decken.
II. Feuersichere Wände.
III. Feuersichere Türen.

Dieselben lassen sich kurz dahin zusammenfassen, dass die Klasse

zeitweiser Schutz Widerstand gegen Feuer für mindestens ¾ Stunden,

teilweiser Schutz Widerstand gegen heftiges Feuer für mindestens 1½ Stunden,

voller Schutz Widerstand gegen heftiges Feuer für mindestens 2½ Stunden voraussetzt.

Die genauen Bedingungen, unter denen dieser Widerstand geleistet werden muss, besonders hinsichtlich der Mindesttemperatur, Dicke des Materials, Belastung und in Bezug auf Bespritzen mit kaltem Wasser unter Druck werden die Jnteressenten leicht aus den Tabellen entnehmen können. Für das Publikum aber, auf dessen Jnteresse an dieser Klassification grosser Wert gelegt werden muss, wird die Dauer des Widerstandes allein maasgebend sein.

Es ist wünschenswert, dass diese Klassification sowohl in England, als auch auf dem Continent und in den Vereinigten Staaten allgemein anerkannt werde und in Zukunft ein einheitliches Klassificationssystem in allen Ländern herrsche.

Mit den Vorarbeiten hierfür ist bereits begonnen worden.

Vorgeschlagen im Auftrage des Geschäftsausschusses.

EDWIN O. SACHS, *Vorsitzender.*
ELLIS MARSLAND, *Ehrenschriftführer.*

NORMEN FUER FEUERSICHERE FUSSBÖDEN U. DECKEN.

KLASSIFIKATION.	Untere Klasse.	Geringste Zeitdauer des Versuchs.	Minimum Temperatur.	Belastung per q.m. Fläche.	Kleinste Fläche für den Test.	Geringste Zeit für das Bespritzen mit Wasser.
Zeitweiser Schutz ...	Klasse A	45 min.	315·5° C.	Beliebig	9·290 q.m.	2 min.
	Klasse B	60 min.	315·5° C.	Beliebig	18·580 q.m	2 min.
Teilweiser Schutz ...	Klasse A	90 min.	982·2° C.	546·852 kg.	9·290 q.m	2 min.
	Klasse B	120 min.	982 2° C.	820·278 kg.	18·580 q m.	2 min.
Voller Schutz	Klasse A	150 min.	982·2° C.	1093·706 kg.	9·290 q.m.	2 min.
	Klasse B	240 min.	982·2° C.	1367·130 kg.	18·580 q.m.	5 min.

NORMEN FUER FEUERSICHERE ZWISCHEN-WAENDE.

Klassifikation.	Untere Klasse.	Geringste Zeitdauer des Versuchs.	Minimum Temperatur.	Dicke.	Kleinste Fläche für den Test.	Geringste Zeit für das Bespritzen mit Wasser.
Zeitweiser Schutz ...	Klasse A	45 min.	815·5° C.	·051 m. & unter	7·432 q m.	2 min.
	Klasse B	60 min.	815·5° C.	Beliebig	7·432 q.m	2 min.
Teilweiser Schutz ...	Klasse A	90 min.	982·2° C.	·063 m. & unter	7·432 q.m.	2 min.
	Klasse P	120 min.	982·2° C.	Beliebig	7·432 q.m.	2 min.
Voller Schutz	Klasse A	150 min.	982·2° C.	·063 m. & unter	7·432 q.m.	2 min.
	Klasse B	240 min.	982·2° C.	Beliebig	7·432 q.m.	5 min.

NORMEN FUER FEUERSICHERE EINZEL TUEREN.

Klassifikation.	Untere Klasse.	Geringste Zeitdauer des Versuchs.	Minimum Temperatur.	Dicke.	Kleinste Fläche für den Test.	Geringste Zeit für das Bespritzen mit Wasser.
Zeitweiser Schutz ...	Klasse A	45 min.	815·5° C.	·051 m. & unter	1·858 q.m.	2 min.
	Klasse B	60 min.	815·5° C.	Beliebig	1·858 q.m.	2 min.
Teilweiser Schutz ...	Klasse A	90 min.	982·2° C.	·063 m. & unter	1·858 q.m.	2 min.
	Klasse B	120 min.	982·2° C.	Beliebig	1·858 q.m.	2 min.
Voller Schutz	Klasse A	150 min.	982·2° C.	·013 m. & unter	2·322 q.m.	2 min.
	Klasse B	240 min.	982·2° C.	Beliebig	2·322 q.m.	5 min.

Table of Degrees Centigrade Equivalent to Degrees Fahrenheit.

Fahr.	Cent.	Fahr.	Cent.	Fahr.	Cent.	Fahr.	Cent.	Fahr.	Cent.
*1	−17·2	51	10·5	101	38·3	151	66·1	201	93·8
2	−16·6	52	11·1	102	38·8	152	66·6	202	94·4
3	−16·1	53	11·6	103	39·4	153	67·2	203	95·0
4	−15·5	54	12·2	104	40·0	154	67·7	204	95·5
5	−15·0	55	12·7	105	40·5	155	68·3	205	96·1
6	−14·4	56	13·3	106	41·1	156	68·8	206	96·6
7	−13·8	57	13·8	107	41·6	157	69·4	207	97·2
8	−13·3	58	14·4	108	42·2	158	70·0	208	97·7
9	−12·7	59	15·0	109	42·7	159	70·5	209	98·3
10	−12·2	60	15·5	110	43·3	160	71·1	210	98·8
11	−11·6	61	16·1	111	43·8	161	71·6	211	99·4
12	−11·1	62	16·6	112	44·4	162	72·2	212	100·0
13	−10·5	63	17·2	113	45·0	163	72·7	213	100·5
14	−10·0	64	17·7	114	45·5	164	73·3	214	101·1
15	− 9·4	65	18·3	115	46·1	165	73·8	215	101·6
16	− 8·8	66	18·8	116	46·6	166	74·4	216	102·2
17	− 8·3	67	19·4	117	47·2	167	75·0	217	102·7
18	− 7·7	68	20·0	118	47·7	168	75·5	218	103·3
19	− 7·2	69	20·5	119	48·3	169	76·1	219	103·8
20	− 6·6	70	21·1	120	48·8	170	76·6	220	104·4
21	− 6·1	71	21·6	121	49·4	171	77·2	221	105·0
22	− 5·5	72	22·2	122	50·0	172	77·7	222	105·5
23	− 5·0	73	22·7	123	50·5	173	78·3	223	106·1
24	− 4·4	74	23·3	124	51·1	174	78·8	224	106·6
25	− 3·8	75	23·8	125	51·6	175	79·4	225	107·2
26	− 3·3	76	24·4	126	52·2	176	80·0	226	107·7
27	− 2·7	77	25·0	127	52·7	177	80·5	227	108·3
28	− 2·2	78	25·5	128	53·3	178	81·1	228	108·8
29	− 1·6	79	26·1	129	53·8	179	81·6	229	109·4
30	− 1·1	80	26·6	130	54·4	180	82·2	230	110·0
*31	− 0·5	81	27·2	131	55·0	181	82·7	231	110·5
32	0·0	82	27·7	132	55·5	182	83·3	232	111·1
33	0·5	83	28·3	133	56·1	183	83·8	233	111·6
34	1·1	84	28·8	134	56·6	184	84·4	234	112·2
35	1·6	85	29·4	135	57·2	185	85·0	235	112·7
36	2·2	86	30·0	136	57·7	186	85·5	236	113·3
37	2·7	87	30·5	137	58·3	187	86·1	237	113·8
38	3·3	88	31·1	138	58·8	188	86·6	238	114·4
39	3·8	89	31·6	139	59·4	189	87·2	239	115·0
40	4·4	90	32·2	140	60·0	190	87·7	240	115·5
41	5·0	91	32·7	141	60·5	191	88·3	241	116·1
42	5·5	92	33·3	142	61·1	192	88·8	242	116·6
43	6·1	93	33·8	143	61·6	193	89·4	243	117·2
44	6·6	94	34·4	144	62·2	194	90·0	244	117·7
45	7·2	95	35·0	145	62·7	195	90·5	245	118·3
46	7·7	96	35·5	146	63·3	196	91·1	246	118·8
47	8·3	97	36·1	147	63·8	197	91·6	247	119·4
48	8·8	98	36·6	148	64·4	198	92·2	248	120·0
49	9·4	99	37·2	149	65·0	199	92·7	249	120·5
50	10·0	100	37·7	150	65·5	200	93·3	250	121·1

* Note.—*The figures from* 1 *to* 31 *Fahr. in the Centigrade column are all minus* 0 00 *Cent.*

Note.—*To convert Fahr. into Cent. deduct* 32. *Multiply by* 5, *and then divide by* 9.

Approximate!

Table of Degrees Centigrade Equivalent to Degrees Fahrenheit.

Fahr.	Cent.	Fahr.	Cent.	Fahr.	Cent.	Fahr.	Cent.	Fahr.	Cent.
251	121·6	300	148·8	550	287·7	800	426·6	1050	565·5
252	122·2	305	151·6	555	290·5	805	429·4	1055	568·3
253	122·7	310	154·4	560	293·3	810	432·2	1060	571·1
254	123·3	315	157·2	565	296·1	815	435·0	1065	573·8
255	123·8	320	160·0	570	298·8	820	437·7	1070	576·6
256	124·4	325	162·7	575	301·6	825	440·5	1075	579·4
257	125·0	330	165·5	580	304·4	830	443·3	1080	582·2
258	125·5	335	168·3	585	307·2	835	446·1	1085	585·0
259	126·1	340	171·1	590	310·0	840	448·8	1090	587·7
260	126·6	345	173·8	595	312·7	845	451·6	1095	590·5
261	127·2	350	176·6	600	315·5	850	454·4	1100	593·3
262	127·7	355	179·4	605	318·3	855	457·2	1105	596·1
263	128·3	360	182·2	610	321·1	860	460·0	1110	598·8
264	128·8	365	185·0	615	323·8	865	462·7	1115	601·6
265	129·4	370	187·7	620	326·6	870	465·5	1120	604·4
266	130·0	375	190·5	625	329·4	875	468·3	1125	607·2
267	130·5	380	193·3	630	332·2	880	471·1	1130	610·0
268	131·1	385	196·1	635	335·0	885	473·8	1135	612·7
269	131·6	390	198·8	640	337·7	890	476·6	1140	615·5
270	132·2	395	201·6	645	340·5	895	479·4	1145	618·3
271	132·7	400	204·4	650	343·3	900	482·2	1150	621·1
272	133·3	405	207·2	655	346·1	905	485·0	1155	623·8
273	133·8	410	210·0	660	348·8	910	487·7	1160	626·6
274	134·4	415	212·7	665	351·6	915	490·5	1165	629·4
275	135·0	420	215·5	670	354·4	920	493·3	1170	632·2
276	135·5	425	218·3	675	357·2	925	496·1	1175	635·0
277	136·1	430	221·1	680	360·0	930	498·8	1180	637·7
278	136·6	435	223·8	685	362·7	935	501·6	1185	640·5
279	137·2	440	226·6	690	365·5	940	504·4	1190	643·3
280	137·7	445	229·4	695	368·3	945	507·2	1195	646·1
281	138·3	450	232·2	700	371·1	950	510·0	1200	648·8
282	138·8	455	235·0	705	373·8	955	512·7	1205	651·6
283	139·4	460	237·7	710	376·6	960	515·5	1210	654·4
284	140·0	465	240·5	715	379·4	965	518·3	1215	657·2
285	140·5	470	243·3	720	382·2	970	521·1	1220	660·0
286	141·1	475	246·1	725	385·0	975	523·8	1225	662·7
287	141·6	480	248·8	730	387·7	980	526·6	1230	665·5
288	142·2	485	251·6	735	390·5	985	529·4	1235	668·3
289	142·7	490	254·4	740	393·3	990	532·2	1240	671·1
290	143·3	495	257·2	745	396·1	995	535·0	1245	673·8
291	143·8	500	260·0	750	398·8	1000	537·7	1250	676·6
292	144·4	505	262·7	755	401·6	1005	540·5	1255	679·4
293	145·0	510	265·5	760	404·4	1010	543·3	1260	682·2
294	145·5	515	268·3	765	407·2	1015	546·1	1265	685·0
295	146·1	520	271·1	770	410·0	1020	548·8	1270	687·7
296	146·6	525	273·8	775	412·7	1025	551·6	1275	690·5
297	147·2	530	276·6	780	415·5	1030	554·4	1280	693·3
298	147·7	535	279·4	785	418·3	1035	557·2	1285	696·1
299	148·3	540	282·2	790	421·1	1040	560·0	1290	698·8
300	148·8	545	285·0	795	423·8	1045	562·7	1295	701·6

Approximate!

Table of Degrees Centigrade Equivalent to degrees Fahrenheit.

Fahr.	Cent.	Fahr.	Cent.	Fahr.	Cent.	Fahr.	Cent.	Fahr.	Cent.
1300	704·4	1550	843·3	1800	982·2	2050	1121·1	2300	1260·0
1305	707·2	1555	846·1	1805	985·0	2055	1123·8	2305	1262·7
1310	710·0	1560	848·8	1810	987·7	2060	1126·6	2310	1265·5
1315	712·7	1565	851·6	1815	990·5	2065	1129·4	2315	1268·3
1320	715·5	1570	854·4	1820	993·3	2070	1132·2	2320	1271·1
1325	718·3	1575	857·2	1825	996·1	2075	1135·0	2325	1273·8
1330	721·1	1580	860·0	1830	998·8	2080	1137·7	2330	1276·6
1335	723·8	1585	862·7	1835	1001·6	2085	1140·5	2335	1279·4
1340	726·6	1590	865·5	1840	1004·4	2090	1143·3	2340	1282·2
1345	729·4	1595	868·3	1845	1007·2	2095	1146·1	2345	1285·0
1350	732·2	1600	871·1	1850	1010·0	2100	1148·8	2350	1287·7
1355	735·0	1605	873·8	1855	1012·7	2105	1151·6	2355	1290·5
1360	737·7	1610	876·6	1860	1015·5	2110	1154·4	2360	1293·3
1365	740·5	1615	879·4	1865	1018·3	2115	1157·2	2365	1296·1
1370	743·3	1620	882·2	1870	1021·1	2120	1160·0	2370	1298·8
1375	746·1	1625	885·0	1875	1023·8	2125	1162·7	2375	1301·6
1380	748·8	1630	887·7	1880	1026·6	2130	1165·5	2380	1304·4
1385	751·6	1635	890·5	1885	1029·4	2135	1168·3	2385	1307·2
1390	754·4	1640	893·3	1890	1032·2	2140	1171·1	2390	1310·0
1395	757·2	1645	896·1	1895	1035·0	2145	1173·8	2395	1312·7
1400	760·0	1650	898·8	1900	1037·7	2150	1176·6	2400	1315·5
1405	762·7	1655	901·6	1905	1040·5	2155	1179·4	2405	1318·3
1410	765·5	1660	904·4	1910	1043·3	2160	1182·2	2410	1321·1
1415	768·3	1665	907·2	1915	1046·1	2165	1185·0	2415	1323·8
1420	771·1	1670	910·0	1920	1048·8	2170	1187·7	2420	1326·6
1425	773·8	1675	912·7	1925	1051·6	2175	1190·5	2425	1329·4
1430	776·6	1680	915·5	1930	1054·4	2180	1193·3	2430	1332·2
1435	779·4	1685	918·3	1935	1057.2	2185	1196·1	2435	1335·0
1440	782·2	1690	921·1	1940	1060·0	2190	1198·8	2440	1337·7
1445	785·0	1695	923·8	1945	1062·7	2195	1201·6	2445	1340·5
1450	787·7	1700	926·6	1950	1065·5	2200	1204·4	2450	1343·3
1455	790·5	1705	929·4	1955	1068·3	2205	1207·2	2455	1346·1
1460	793·3	1710	932·2	1960	1071·1	2210	1210·0	2460	1348·8
1465	796·1	1715	935·0	1965	1073·8	2215	1212·7	2465	1351·6
1470	798·8	1720	937·7	1970	1076·6	2220	1215·5	2470	1354·4
1475	801·6	1725	940·5	1975	1079·4	2225	1218·3	2475	1357·2
1480	804·4	1730	943·3	1980	1082·2	2230	1221·1	2480	1360·0
1485	807·2	1735	946·1	1985	1085·0	2235	1223·8	2485	1362·7
1490	810·0	1740	948·8	1990	1087·7	2240	1226·6	2490	1365·5
1495	812·7	1745	951·6	1995	1090·5	2245	1229·4	2495	1368·3
1500	815·5	1750	954·4	2000	1093·3	2250	1232·2	2500	1371·1
1505	818·3	1755	957·2	2005	1096·1	2255	1235·0	2505	1373·8
1510	821·1	1760	960·0	2010	1098·8	2260	1237·7	2510	1376·6
1515	823·8	1765	962·7	2015	1101·6	2265	1240·5	2515	1379·4
1520	826·6	1770	965·5	2020	1104·4	2270	1243·3	2520	1382·2
1525	829·4	1775	968·3	2025	1107·2	2275	1246·1	2525	1385·0
1530	832·2	1780	971·1	2030	1110·0	2280	1248·8	2530	1387·7
1535	835·0	1785	973·8	2035	1112·7	2285	1251·6	2535	1390·5
1540	837·7	1790	976·6	2040	1115·5	2290	1254·4	2540	1393·3
1545	840·5	1795	979·4	2045	1118·3	2295	1257·2	2545	1396·1

Approximate!

INCHES AND FRACTIONS OF INCHES CONVERTED INTO MÈTRES.

Ins.	0	1	2	3	4	5	6	7	8	9	10	11	12
	...	·0254	·0508	·0762	·1016	·1270	·1524	·1778	·2032	·2286	·2540	·2793	·3047
1/16	·0015	·0269	·0523	0777	·1032	·1286	·1539	·1793	·2047	·2301	·2555	·2809	1/16
1/8	·0031	·0285	·0539	·0793	·1047	·1301	·1555	1809	·2063	·2317	·2571	·2825	1/8
3/16	·0047	0301	0555	·0809	·1063	·1317	·1571	·1825	·2079	·2333	2587	·2841	3/16
1/4	·0063	·0317	·0571	·0825	·1079	·1333	·1587	·1841	·2095	·2349	·2603	·2857	1/4
5/16	·0079	0333	·0587	·0841	·1095	·1349	·1603	·1857	·2111	·2365	·2619	·2873	5/16
3/8	·0095	·0349	·0603	·0857	·1111	·1365	·1619	·1873	·2127	·2381	·2635	·2889	3/8
7/16	·0111	·0365	·0619	0873	·1127	·1381	·1635	·1889	·2143	·2397	·2651	·2905	7/16
1/2	·0127	·0380	·0635	·0888	·1143	·1397	·1651	·1905	·2159	·2413	·2667	·2920	1/2
9/16	·0142	·0396	·0650	·0904	·1158	·1412	1666	·1920	·2174	·2428	·2682	·2936	9/16
5/8	·0158	·0412	·0666	·0920	·1174	·1428	·1682	·1936	·2190	·2444	·2698	·2952	5/8
11/16	·0174	·0428	0682	·0936	·1190	·1444	·1698	·1952	·2206	·2460	·2714	·2968	11/16
3/4	·0190	·0444	·0698	·0952	·1206	·1460	·1714	·1968	·2222	·2476	·2730	·2984	3/4
13/16	·0206	·0460	·0714	·0968	·1222	·1476	·1730	·1984	·2238	·2492	·2746	·3000	13/16
7/8	·0222	·0476	·0730	·0984	·1238	·1493	·1746	·2000	·2254	·2508	·2762	·3016	7/8
15/16	·0238	·0492	·0746	·1000	1254	·1508	·1762	·2016	·2270	·2524	2778	·3033	15/16
Ins.	0	1	2	3	4	5	6	7	8	9	10	11	Ins.

Approximate! *Do not multiply these figures.*

FEET AND INCHES CONVERTED INTO MÈTRES.

Feet		Mètres	Feet		Mètres	Feet		Mètres	Feet		Mètres
0″	=	...	7′ 6″	=	2·2859	15′ 0″	=	4·5718	22′ 6″	=	6·8577
3″	=	0·0762	9	=	2·3621	3	=	4·6479	9	=	6·9339
6″	=	0·1524	8′ 0″	=	2·4383	6	=	4·7242	23′ 0″	=	7·0101
9″	=	0·2286	3	=	2·5144	9	=	4·8004	3	=	7·0862
1′ 0″	=	0·3047	6	=	2·5907	16′ 0″	=	4·8766	6	=	7·1625
3	=	0·3808	9	=	2·6669	3	=	4·9527	9	=	7·2387
6	=	0·4571	9′ 0″	=	2·7431	6	=	5·0290	24′ 0″	=	7·3149
9	=	0·5333	3	=	2·8192	9	=	5·1052	3	=	7·3910
2′ 0″	=	0·6095	6	=	2·8955	17′ 0″	=	5·1814	6	=	7·4673
3	=	0·6856	9	=	2·9717	3	=	5·2575	9	=	7·5435
6	=	0·7619	10′ 0″	=	3·0479	6	=	5·3338	25′ 0″	=	7·6197
9	=	0·8381	3	=	3·1240	9	=	5·4100	3	=	7·6958
3′ 0″	=	0·9143	6	=	3·2003	18′ 0″	=	5·4862	6	=	7·7721
3	=	0·9904	9	=	3·2765	3	=	5·5623	9	=	7·8483
6	=	1·0667	11′ 0″	=	3·3526	6	=	5·6386	26′ 0″	=	7·9245
9	=	1·1429	3	=	3·4287	9	=	5·7148	3	=	8·0006
4′ 0″	=	1·2191	6	=	3·5050	19′ 0″	=	5·7910	6	=	8·0769
3	=	1·2952	9	=	3·5812	3	=	5·8671	9	=	8·1531
6	=	1·3715	12′ 0″	=	3·6574	6	=	5·9434	27′ 0″	=	8·2293
9	=	1·4477	3	=	3·7335	9	=	6·0196	3	=	8·3054
5′ 0″	=	1·5239	6	=	3·8098	20′ 0″	=	6·0958	6	=	8·3817
3	=	1·6000	9	=	3·8860	3	=	6·1719	9	=	8·4579
6	=	1·6763	13′ 0″	=	3·9622	6	=	6·2482	28′ 0″	=	8·5341
9	=	1·7525	3	=	4·0383	9	=	6·3244	3	=	8·6102
6′ 0″	=	1·8287	6	=	4·1146	21′ 0″	=	6·4005	6	=	8·6865
3	=	1·9048	9	=	4·1908	3	=	6·4766	9	=	8·7627
6	=	1·9811	14′ 0″	=	4·2670	6	=	6·5529	29′ 0″	=	8·8389
9	=	2·0573	3	=	4·3431	9	=	6·6291	3	=	8·9150
7′ 0″	=	2·1335	6	=	4·4194	22′ 0″	=	6·7053	6	=	8·9913
3	=	2·2096	9	=	4·4956	3	=	6·7814	9	=	9·0675

Approximate! *Do not multiply these figures.*

Table of Kilogrammes Equivalent to Lbs. Avoirdupois.

Lbs.	Kilos.	Lbs.	Kilos.	Lbs.	Kilos.	Lbs.	Kilos.	Lbs.	Kilos.	Lbs.	Kilos.
1 =	·4536	51 =	23·1332	101 =	45·8129	160 =	72·5749	700 =	317·515	3200 =	1451·4
2 =	·9072	52 =	23·5868	102 =	46·2665	170 =	77·1108	750 =	340·194	3250 =	1474·1
3 =	1·3608	53 =	24·0404	103 =	46·7201	180 =	81·6467	800 =	362·874	3300 =	1496·8
4 =	1·8143	54 =	24·4940	104 =	47·1736	190 =	86·1827	850 =	385·554	3350 =	1519·5
5 =	2·2680	55 =	24·9476	105 =	47·6273	200 =	90·7185	900 =	408·233	3400 =	1542·2
6 =	2·7216	56 =	25·4012	106 =	48·0809	210 =	95·2545	950 =	430·913	3450 =	1564·9
7 =	3·1751	57 =	25·8548	107 =	48·5344	220 =	99·7904	1000 =	453·593	3500 =	1587·5
8 =	3·6287	58 =	26·3084	108 =	48·9880	230 =	104·3263	1050 =	476·272	3550 =	1610·2
9 =	4·0823	59 =	26·7620	109 =	49·4416	240 =	108·8616	1100 =	498·952	3600 =	1632·9
10 =	4·5360	60 =	27·2156	110 =	49·8953	250 =	113·398	1150 =	521·632	3650 =	1655·6
11 =	4·9895	61 =	27·6691	111 =	50·3488	260 =	117·934	1200 =	544·311	3700 =	1678·2
12 =	5·4431	62 =	28·1227	112 =	50·8024	270 =	122·470	1250 =	566·991	3750 =	1700·9
13 =	5·8967	63 =	28·5763	113 =	51·2560	280 =	127·000	1300 =	589·671	3800 =	1723·6
14 =	6·3503	64 =	29·0299	114 =	51·7096	290 =	131·542	1350 =	612·351	3850 =	1746·3
15 =	6·8039	65 =	29·4835	115 =	52·1632	300 =	136·078	1400 =	635·030	3900 =	1769·0
16 =	7·2575	66 =	29·9371	116 =	52·6168	310 =	140·614	1450 =	657·710	3950 =	1791·6
17 =	7·7111	67 =	30·3907	117 =	53·0704	320 =	145·150	1500 =	680·389	4000 =	1814·3
18 =	8·1647	68 =	30·8443	118 =	53·5240	330 =	149·686	1550 =	703·069	4050 =	1837·0
19 =	8·6183	69 =	31·2979	119 =	53·9776	340 =	154·222	1600 =	725·749	4100 =	1859·7
20 =	9·0718	70 =	31·7515	120 =	54·4312	350 =	158·757	1650 =	748·429	4150 =	1882·4
21 =	9·5255	71 =	32·2051	121 =	54·8848	360 =	163·293	1700 =	771·108	4200 =	1905·0
22 =	9·9790	72 =	32·6587	122 =	55·3382	370 =	167·829	1750 =	793·788	4250 =	1927·7
23 =	10·4326	73 =	33·1122	123 =	55·7919	380 =	172·365	1800 =	816·467	4300 =	1950·4
24 =	10·8862	74 =	33·5658	124 =	56·2454	390 =	176·901	1850 =	839·147	4350 =	1973·1
25 =	11·3398	75 =	34·0194	125 =	56·6991	400 =	181·437	1900 =	861·826	4400 =	1995·8
26 =	11·7934	76 =	34·4730	126 =	57·1526	410 =	185·973	1950 =	884·506	4450 =	2018·4
27 =	12·2470	77 =	34·9266	127 =	57·6063	420 =	190·509	2000 =	907·185	4500 =	2041·1
28 =	12·7000	78 =	35·3802	128 =	58·0598	430 =	195·045	2050 =	929·865	4550 =	2063·8
29 =	13·1542	79 =	35·8338	129 =	58·5135	440 =	199·581	2100 =	952·545	4600 =	2086·5
30 =	13·6078	80 =	36·2874	130 =	58·9670	450 =	204·117	2150 =	975·225	4650 =	2109·2
31 =	14·0614	81 =	36·7410	131 =	59·4207	460 =	208·653	2200 =	997·904	4700 =	2131·8
32 =	14·5150	82 =	37·1946	132 =	59·8742	470 =	213·189	2250 =	1020·584	4750 =	2154·5
33 =	14·9686	83 =	37·6482	133 =	60·3279	480 =	217·725	2300 =	1043·263	4800 =	2177·2
34 =	15·4222	84 =	38·1018	134 =	60·7814	490 =	222·260	2350 =	1065·943	4850 =	2199·9
35 =	15·8757	85 =	38·5554	135 =	61·2350	500 =	226·796	2400 =	1088·622	4900 =	2222·6
36 =	16·3293	86 =	39·0090	136 =	61·6886	510 =	231·332	2450 =	1111·302	4950 =	2245·2
37 =	16·7829	87 =	39·4626	137 =	62·1422	520 =	235·868	2500 =	1133·981	5000 =	2267·9
38 =	17·2365	88 =	39·9162	138 =	62·5958	530 =	240·404	2550 =	1156·661	5050 =	2290·6
39 =	17·6901	89 =	40·3697	139 =	63·0494	540 =	244·940	2600 =	1179·341	5100 =	2313·3
40 =	18·1437	90 =	40·8233	140 =	63·5030	550 =	249·476	2650 =	1202·021	5150 =	2336·0
41 =	18·5973	91 =	41·2769	141 =	63·9566	560 =	254·012	2700 =	1224·700	5200 =	2358·6
42 =	19·0509	92 =	41·7305	142 =	64·4102	570 =	258·548	2750 =	1247·380	5250 =	2381·3
43 =	19·5045	93 =	42·1841	143 =	64·8638	580 =	263·084	2800 =	1270·059	5300 =	2404·0
44 =	19·9581	94 =	42·6377	144 =	65·3174	590 =	267·620	2850 =	1292·739	5350 =	2426·7
45 =	20·4117	95 =	43·0913	145 =	65·7710	600 =	272·156	2900 =	1315·419	5400 =	2449·4
46 =	20·8653	96 =	43·5449	146 =	66·2244	610 =	276·691	2950 =	1338·099	5450 =	2472·0
47 =	21·3189	97 =	43·9985	147 =	66·6780	620 =	281·227	3000 =	1360·779	5500 =	2494·7
48 =	21·7725	98 =	44·4521	148 =	67·1316	630 =	285·763	3050 =	1383·459	5550 =	2517·4
49 =	22·2260	99 =	44·9057	149 =	67·5852	640 =	290·299	3100 =	1406·138	5600 =	2540·1
50 =	22·6796	100 =	45·5393	150 =	68·0388	650 =	294·835	3150 =	1428·818	5650 =	2562·7

Approximate! *Do not multiply these figures*

NOTE:

1 Cwt. = 112 lbs. = 50·8024 Kilogrammes.
1 Ton = 2,240 lbs. = 1016·048 Kilogrammes.
1 Kilogramme = 2·2046213 lbs. avoirdupois.
1 Gramme = 15·432349 Grains.

THE

British Fire Prevention Committee

[FOUNDED 1897.—INCORPORATED 1899.]

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Bankers :

LONDON AND SOUTH WESTERN BANK,
Regent Street, W.

Testing Station :

WESTBOURNE LODGE, BAYSWATER, W.

Offices :

1, WATERLOO PLACE, PALL MALL, LONDON, S.W.
(CHARLES ADAMI, *Assistant Secretary.*)

OBJECTS OF THE COMMITTEE:

The main objects of the Committee are :—

To direct attention to the urgent need for increased protection of life and property from fire by the adoption of preventive measures.

To use its influence in every direction towards minimising the possibilities and dangers of fire.

To bring together those scientifically interested in the subject of Fire Prevention.

To arrange periodical meetings for the discussion of practical questions bearing on the same.

To establish a reading-room, library and collections for purposes of research, and for supplying recent and authentic information on the subject of Fire Prevention.

To publish from time to time papers specially prepared for the Committee, together with records, extracts, and translations.

To undertake such independent investigations and tests of materials, methods and appliances as may be considered advisable.

The Committee's Reports on Tests with Materials, Methods of Construction, or Appliances are intended solely to state bare facts and occurrences, with tables, diagrams, or illustrations, and they are on no account to be read as expressions of opinion, criticisms, or comparisons.

NOTE.

This is a report on a built up plaster slab-partition.

Partitions of this class, of which now several have been reported upon by the Committee, are intended to afford temporary protection in the interior of buildings as well as to minimize space.

ELLIS MARSLAND.

LONDON,
May 25th, 1904.

THE GENERAL ARRANGEMENTS FOR TESTS.

(MEMORANDUM.)

THE purpose of the tests undertaken by the British Fire Prevention Committee is to obtain reliable data as to the exact fire-resistance of the various materials, systems of construction, or appliances used in building practice.

The tests are of an entirely independent character, arranged on scientific lines, but with full consideration for the practical purpose in view. Absolute reliability is assured, records being mostly taken automatically, or by photography, and the temperatures being easily regulated by the application of gas.

All reports on tests solely state the bare facts and occurrences, with tables, diagrams, and illustrations, and on no account are reports to be taken as including expressions of opinion, nor should any expression be read as a comparison or criticism.

The general arrangement and direction of the tests are in the hands of the Executive, who act in accordance with certain principles laid down after careful study and experiment. The official tests are attended by the members of the Council and the members of the Committee in rotation.

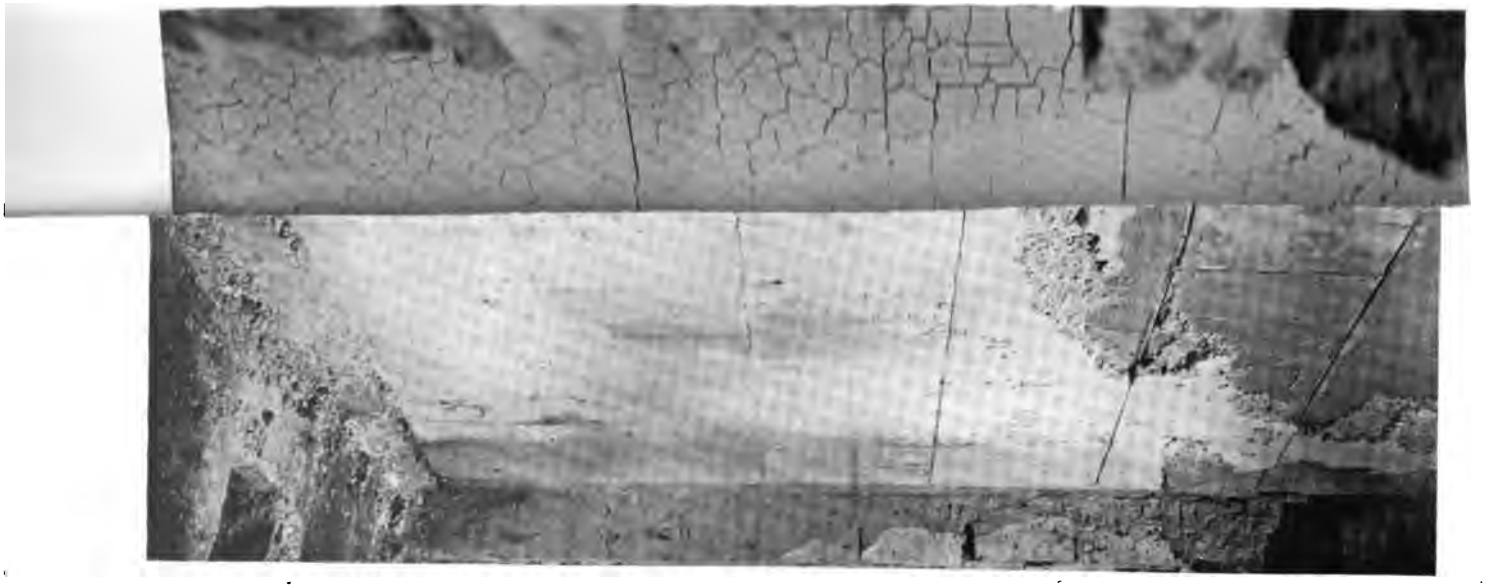
As to the Committee's present Testing Station, it comprises a house, standing in its own grounds, near Royal Oak Station, and backing on to the Great Western Railway. The principal building is used for Committee Rooms and laboratory purposes, whilst the gardens are utilised for so-called "full-size" tests.

As to the financial aspect of the station, the establishment expenses are being met by a special subscription. As far as the funds of the committee permit, investigations and experimental tests with ordinary (*i.e.*, not patented) forms of construction are undertaken from time to time and duly reported on. Official tests with patented materials, makers' systems, etc., etc., are subject to a scale of charges, but these charges are so figured as to only just cover the actual cost. The Testing Station is also open to members for such private research work or tests they may desire to undertake.

The services of the members participating in the management of the station, conducting or attending tests, are given entirely gratuitously.

For the Executive,

EDWIN O. SACHS, *Chairman.*



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OFFICIAL REPORTS

OF THE

British Fire Prevention Committee

[FOUNDED, 1897.—INCORPORATED, 1899.]

FIRE TEST No. 49.—MAY 4TH, 1904.

A PARTITION

FORMED WITH

JABEZ THOMPSON'S THIN WHITE PARTITION SLABS,

AND ERECTED BY

JABEZ THOMPSON,

NORTHWICH, CHESHIRE.

OBJECT OF TEST.

To record the effect of a fire of one hour and a quarter duration, at a temperature gradually increasing to about 1,800° Fahr. (*982·2° C.*), but not to exceed 2,100° Fahr. (*1,148·8° C.*), followed by the application of water for two minutes on the fire side.

Note.—The area of the partition under investigation was to be at least 75 ft. (*6·97 □ m.*) superficial, with a width of 10 ft. (*3·048 m.*).

Note.—The time allowed for the construction and drying of the partition was to be four weeks.

SUMMARY OF TEST.

Portions of the slabs flaked off on the fire side of the partition on the application of water.

No effects of the fire were apparent on the passage side of the partition, except small cracks following the courses of the joints which closed up before the conclusion of the test.

The temperature in the passage on the outside of the partition at no time exceeded 100° Fahr. (*37·7° C.*).

Neither fire nor smoke passed through the partition.

On examination after the test the surface of the slabs next the fire was disintegrated and sodden by the water.

DESCRIPTION OF TESTING PLANT.

(*See Figs.* 1 *to* 4.)

The Testing Chamber used was located at the Committee's Testing Station, and was known as "No. 1 Hut."

The hut was constructed, as shown, of stock bricks, with lime mortar, and measured 10 ft. by 10 ft. (*3·048* × *3·048 m.*) internally.

The ceiling was 9 ft. (*2·743 m.*) above the pavement of the hut, and was constructed of wood beams.

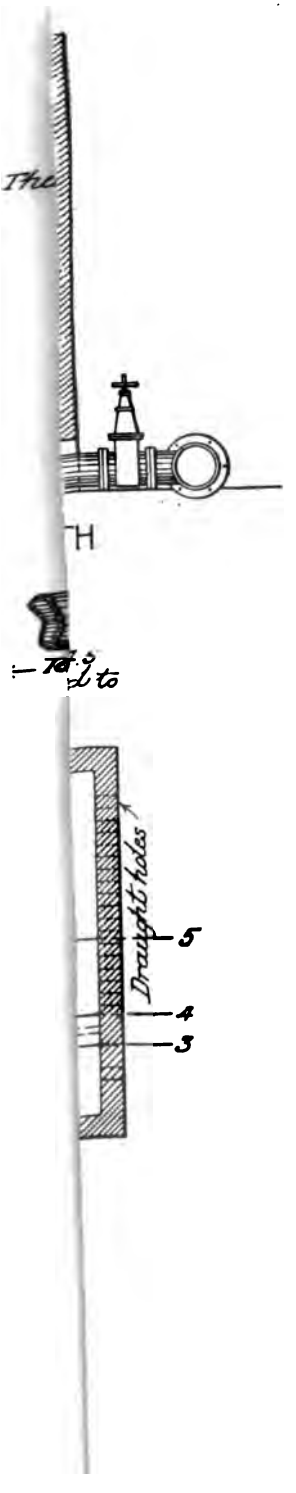
The hut was covered in with a tarpaulin.

The door, opening in the wall, measured 2 ft. by 6 ft. 6 in. (*·61* × *1·981 m.*) and was open during the test.

The fuel used was gas produced at the station, and the supply was regulated by valves and dampers.

The hut was divided as shown on plan, the partition being constructed from north to south, the full width and height of the hut, leaving the passage on the outside 2 ft. 7 in. (*·787 m.*) wide.

The gas was admitted through two mixing chambers of fire-brick each 7 ft. 2½ in. by 3 ft. 6 in. (*2·197* × *1·066 m.*) as shown.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Two Roberts-Austen pyrometers were used for recording temperatures, one taking a continuous record from point No. 5, and one being used for the observation records at points Nos. 1, 2, 3, 4. Points Nos. 1, 4, 5 were inside the chamber, and Nos. 2 and 3 outside in the passage.

There were two observation holes, one in the north and one in the south walls, and two small observation holes in the east wall.

The stream of water was applied to the inside face of partition through the observation hole on the south side, by a branch with $\frac{3}{4}$ in. (*·019 m.*) nozzle, and supplied from a small steam fire engine.

CONSTRUCTION OF THE PARTITION.

(*See Figs. Nos. 1 to 5.*)

Plans, elevations, and sections of the partition are shown.

The construction of the partition was as follows :—

On April 6th and 7th the partition was erected. The slabs forming the partition were built on a course of bricks laid on the floor of the hut, and were carried up to the under side of the ceiling beams to a height of 8 ft. 9 in. (*2·667 m.*). The partition was composed of slabs each $12\frac{5}{16}$ in. (*·312 m.*) in height and $2\frac{3}{16}$ in. thick (*·0714 m.*) and of lengths varying from 1 ft. 3 in. to 3 ft. $1\frac{1}{2}$ in. (*·381 m.* to *·952 m.*). The joints, both horizontal and vertical were V-shaped, grooved and tongued (see detail).

On each side of the partition the walls and ceilings were plastered with a strip 6 in. wide and 1 in. thick.

The partition was not plastered.

The joints of the partition were of plaster of Paris.

The weight as stated by the makers was 150 lbs. (*68 kilos.*) per sq. yard (*·836 □ m.*).

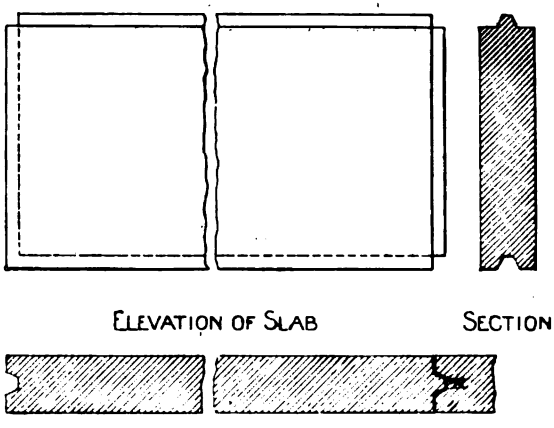


Fig. 5. DETAILS OF THE PARTITION.

On April 25th a coke fire was lighted and kept burning 10 hours a day until May 2nd, when it was removed.

THE TEST.

On May 4, 1904, the test was undertaken. The following is a log of the test :—

At 3 p.m. the meteorological observations taken at the Botanic Gardens, Regent's Park, read as follows :—

"State of weather, cloudy ; Wind, N.W. ; Barometer, 30·16 inches (·*766 m.*) ; attached thermometer, 56° Fahr. (*13·33 C.*) ; Wet Bulb, 56° Fahr. (*13·33 C.*) ; Dry Bulb, 60° Fahr. (*15·5 C.*). Remarks : Fine afternoon."

At 2 p.m. the gas was lighted.

Observations on the Outside.

See Fig. 6.

	Minutes Elapsed.
2.5 p.m. 4th joint opening slightly.	5
2.7 p.m. Steam coming out through joint at junction with ceiling at N and S. top corners and about centre.	7
2.8 p.m. Top complete slab (not narrow piece at top) N. end coming outwards at 7th joint at bottom S. corner about $\frac{1}{32}$ in. (·0007 *m.*) and vertical joint cracked.	8
2.14 p.m. Slab between 4th and 5th joints split vertically in two, in line with joint above (see x Fig. 6). Corner of slab at O (Fig. 6), lower corner bursting out about $\frac{1}{16}$th (·0015 *m.*).	14
2.18 p.m. Steam coming from joint between top of partition and ceiling all along. Joint at O (see Fig. 6), top corner of N. slab cracked off.	18
2.22 p.m. Joints in many places very hot to the hand.	22
2.32 p.m. Partition warm all over. Joint 1 cracked very slightly all along.	32
2.35 p.m. Partition too hot for the palm of the hand to be held on.	35
2.55 p.m. Joints between slabs all closing up, some of the cracks (particularly at joint 1) not now visible.	55

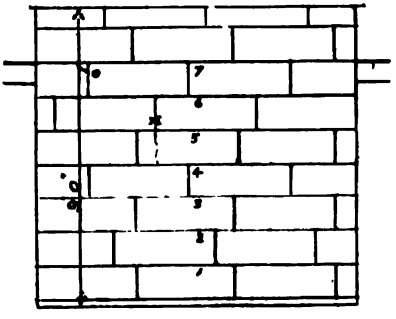


Diagram showing Joints.

Fig. 6.

OBSERVATIONS ON INSIDE.

Minutes Elapsed

2.14 p.m. Hair cracks appeared on the face of some of the slabs above the 5th joint. 14

2.20 p.m. All joints showing distinctly and hair cracks generally all over the surface of the slabs. 20

3.15 p.m. The gas was turned off. 75

The fire had not passed through the partition, and the surface on the passage side, except for the cracks before mentioned, was unaffected by the fire.

3.16 p.m. Water was turned on to the inside face of the partition for two minutes at 55 lbs. pressure (*24·95 kg.*) per square inch (*·155 □ cm.*) 76

The effect of this was to flake off some of the surface of the slabs where struck by the water, but no other effect was apparent. On the outside face the water had leaked through some of the joints.

The temperatures, as read from the observation record off pyrometer points Nos. 1, 2, 3, and 4 were as follows :—

OBSERVATIONS TAKEN FROM POINTS NOS. 1, 2, 3, 4.

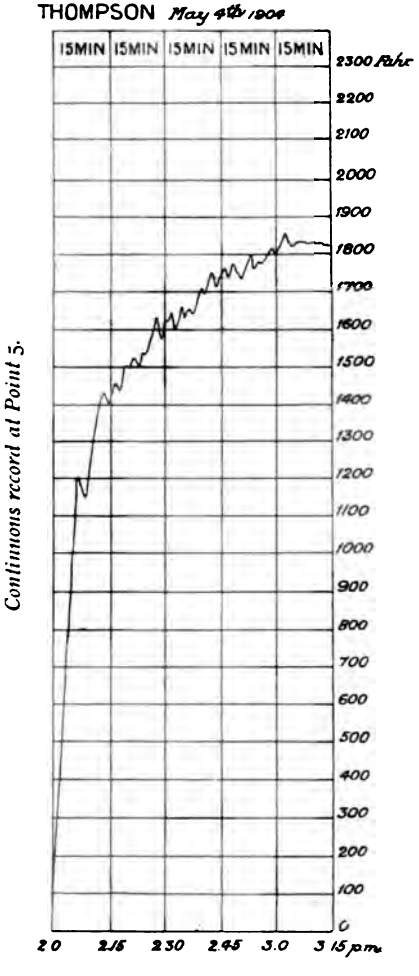
From 2.0 *p.m. to* 3.15 *p.m.*

Time.	Inside.		Outside (in passage).		Minutes Elapsed.
	No. 1.	No. 4.	No. 2.	No. 3.	
	Deg. Fahr.	Deg. Fahr.	Deg. Fahr.	Deg. Fahr.	
2.0 p.m.	—	—	—	—	—
2.3 ,,	800	1200	—	—	3
2.6 ,,	1000	1180	—	—	6
2.9 ,,	950	1180	—	—	9
2.12 ,,	1200	1300	—	—	12
2.15 ,,	1220	1300	—	—	15
	(*660·0*)	(*704·4*)			
2.18 ,,	1310	1340	—	—	18
2.21 ,,	1400	1400	—	—	21
2.24 ,,	1430	1450	—	—	24
2.27 ,,	1460	1460	—	—	27
2.30 ,,	1500	1460	—	—	30
	(*815·5*)	(*793·3*)			
2.33 ,,	1530	1540	—	—	33
2.36 ,,	1550	1570	—	—	36
2.39 ,,	1530	1530	—	—	39
2.42 ,,	1580	1585	—	—	42
2.45 ,,	1580	1580	—	—	45
	(*860·0*)	(*860·0*)			
2.48 ,,	1600	1620	—	—	48
2.51 ,,	1620	1660	—	—	51
2.54 ,,	1660	1660	—	—	54
2.57 ,,	1680	1700	—	—	57
3.0 ,,	1700	1720	—	—	60
	(*926·6*)	(*937·7*)			
3.3 ,,	1710	1740	—	—	63
3.6 ,,	1740	1740	—	—	66
3.9 ,,	1760	1740	—	—	69
3.12 ,,	1780	1750	—	—	72
3.15 ,,	1800	1740	—	—	75
	(*982·2*)	(*948·8*)			

Degrees in italics are in Centigrade.

Note : The temperature in the passage, on the outside of the partition, at no time exceeded 100° Fahr. (*37·7° C.*).

The following is the record taken from the continuous record at Point No. 5 :—



OBSERVATIONS AFTER TEST.

(*Figs.* 7, 8 *and* 9.)

On May 7, 1904, the following observations were made: —The face of the partition on the passage side had

undergone no change since the conclusion of the test.

The stopping for a space of about 4 ins. (·*1016 m.*) in the fourth joint near the centre of the partition had come out, leaving an open space about $\frac{1}{8}$th of an inch (·*0031 m.*).

About one-third of the surface of the inside face of the partition had been flaked off to a depth of about $\frac{7}{8}$th of an inch (·*0222 m.*) where struck by the water jet, exposing the tongue on the slabs.

Where the surface of the slabs had not been flaked off the joints were open about $\frac{1}{8}$th of an inch (·*0031 m.*).

All the surface was more or less cracked and in a soft plastic condition.

GENERAL ARRANGEMENTS.

The Test was carried out according to the procedure laid down by the Executive for investigations of this description, and conducted by a Sub-Committee comprising :—

Mr. Ellis Marsland (District Surveyor, Camberwell), Directing Member.
Mr. Max Clarke, A.R.I.B.A.
Mr. Langridge, A.M.Inst.E.E.
Mr. Bernard Dicksee, A.R.I.B.A. (District Surveyor, Newington).

Messrs. T. Kissack and Lister assisted the Sub-Committee.

Mr. H. B. White, M.Inst.E.E., superintended in the Instrument Room.

Fig. 7. VIEW OF OUTSIDE OF PARTITION BEFORE TEST THROUGH DOORWAY OF HUT.

Fig. 8. VIEW OF OUTSIDE OF PARTITION AFTER TEST THROUGH DOORWAY OF HUT.

The Executive was represented by :—

Mr. Edwin O. Sachs (Chairman).
Mr. Percy Collins.
Mr. J. H. Dyer (Vice-President National Fire Brigades' Union).
Mr. J. W. Restler, M.Inst.C.E. (Chief Engineer Southwark and Vauxhall Waterworks).
Mr. James Sheppard, A.Inst.E.E. (North British and Mercantile Insurance Co.).

The General Body of Members was represented by :—

Mr. T. W. Dunch, Mr. E. J. A. Fulkes, Mr. Horace Folker (Hon. Sec., N.F.B.U.), Mr. Wm. Grellier (District Surveyor, Clapham), Mr. G. E. Hayles, Major H. Huleatt, R.E., Mr. W. H. Leete (County Surveyor, Bedfordshire), Mr. Robert P. Notley (District Surveyor, Bethnal Green), Mr. Huron Short, Mr. George Tolley.

The Industrial Section was represented by :—

Mr. W. Romer (General Electric Co., 1900, Ltd.).

Messrs. Jabez Thompson were represented by :—

Mr. John Thompson, Mr. Arnold Thompson, Mr. W. S. Moore, Mr. W. H. Harvey.

The following visitors attended by special invitation of the Executive :—

Mr. George Bibby, Mr. E. Carpenter (Clerk of Works, Law Courts), Mr. Chas. Dunch, Mr. Chas. Daubney, Mr. J. D. O'Brien, Jun., Mr. Robert Ray, Mr. H. Tripe (Royal Insurance Co.), Major J. R.

Young (Supt. of Buildings, Woolwich Arsenal), Representatives of the Factory Branch and Theatres Branch of the Architects' Department, L.C.C.

Signed,

For the Sub-Committee conducting the Test and for the General Testing Arrangements Sub-Committee.:

ELLIS MARSLAND (*Directing Member*).

For the Executive :

EDWIN O. SACHS (*Chairman*).

Published by the Committee as directed by the Executive.

CHARLES ADAMI (*Assist. Secretary*).

Date—May 30th, 1904.

Verified a true copy of the Report ordered to be published,

ROSE-INNES, SON & CRICK (*Solicitors*).

Date—June, 1904.

List of the Fire Prevention Committee's Publications—*continued.*

49. FIRE TESTS WITH DOORS. A 2½-in. Door of Archangel Deal constructed in Three Thicknesses; a 2½-in. Door of Quebec Pine constructed in Three Thicknesses. Particulars of Experimental Fire Tests.
50. FIRE TESTS WITH DOORS. A 2½-in. Door of Archangel Deal constructed in Three Thicknesses; a 1¾-in. Door of Teak, Flush Panelling on each side, the Panels being in Two Thicknesses. Particulars of Experimental Fire Tests.
51. FIRE TESTS WITH FIRE-RESISTING CURTAINS. Two Fire Blinds, known as the "Williams" Fire Blinds, installed by G. A. Williams & Son, Bayswater, London. The Committee's Report
52. FIRE TESTS WITH PARTITIONS. A Partition formed with "Mack's" Patent Slabs, and erected by M. J. A. King & Co., London. The Committee's Report.
53. FIRE TESTS WITH PARTITIONS. A Partition known as the "Cunnah-Wright" Partition, by the Fireproof Partition Syndicate, Ltd., London. The Committee's Report.
54. FIRE TESTS WITH DOORS. A 2½-in. Door of Oak constructed in Three Thicknesses; a 2¾-in. Door of Teak constructed in Three Thicknesses. Particulars of Experimental Fire Tests.
55. FIRE TESTS WITH FLOORS. A Floor of Deal Joists and Coke Breeze Concrete with Expanded Metal and Plaster Ceiling. Particulars of Experimental Fire Tests.
56. FIRE TESTS WITH FLOORS. A Floor by the Mural and Decorations Syndicate, Ltd., London, being a Double Test. The Committee's Report.
57. FIRE TESTS WITH TREATED WOOD. A Match-boarded Partition of Deal painted with Oil-colour; a Match-boarded Partition of "Non-Flammable" Deal painted with "Non-Flammable" Paint by the London Non-Flammable Wood Company, Ltd., London. The Committee's Report.
58. FIRE TESTS WITH PARTITIONS. A Partition known as the "Cunnah-Wright" Partition, by the Fireproof Partition Syndicate, Ltd., London. The Committee's Report.
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60. FIRE TESTS WITH DOORS. Two Iron Doors. Particulars of Experimental Fire Tests.
61. FIRE TESTS WITH FLOORS. A Floor of Steel Joists with Coke Breeze Concrete. Particulars of Experimental Fire Tests.
62. FIRE TESTS WITH CEILINGS. A Wood Floor and Ceiling protected by an Additional Suspended Ceiling by Banks' Fireproof Construction Syndicate, Ltd., London. The Committee's Report.
63. FIRE TESTS WITH PARTITIONS. A Partition erected by Banks' Fireproof Construction Syndicate, Ltd., London. The Committee's Report.
64. FIRE TESTS WITH FLOORS. A Floor by Banks' Fireproof Construction Syndicate, Ltd., London. The Committee's Report.
65. The Testing Arrangements of the British Fire Prevention Committee. Some Notes with Illustrations. By ELLIS MARSLAND.
66. FIRE TESTS WITH AUTOMATIC FIRE ALARMS. Closed Circuit and Open Circuit Automatic Fire Alarms, by Pearson's Fire Alarm System, Ltd., London. The Committee's Report.
67. FIRE TESTS WITH DOORS. A Door composed of Deal and Uralite covered externally with Tinned Steel; a Door composed of Deal and Uralite covered externally with Uralite, by the British Uralite Company, Ltd., London. The Committee's Report.
68. FIRE TESTS WITH DOORS. A 1¾-in. Framed "Jarrah" Door, with 1¾-in. Solid Panels; a 1¾-in. Framed "Karri" Door, with 1¾-in. Solid Panels, by Messrs. Millars' Karri and Jarrah Forests, Ltd., London. The Committee's Report.
69. FIRE TESTS WITH DOORS. Two 2-in. Doors of Deal, hung in one opening, with a space between the Doors; two 2-in. Doors of Oak, hung in one opening, with a space between the Doors. Particulars of Experimental Fire Tests.
70. FIRE TESTS WITH DOORS. A 2-in. "Jarrah" Four-Panel Bead Flush Both Sides Door; a 2-in. "Karri" Four-Panel Bead Flush Both Sides Door, by Messrs. Millars' Karri and Jarrah Forests, Ltd., London. The Committee's Report.
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73. FIRE TESTS WITH FLOORS. A Floor of Fir Supports and Oak Flooring. Particulars of Experimental Tests.
74. FIRE TESTS WITH PARTITIONS. A Partition formed with Phœnix Fire-Resisting Slabs, erected by Messrs. Van der Vygh Bros., Amsterdam. The Committee's Report.
75. INTERNATIONAL FIRE PREVENTION CONGRESS, 1903, convened by the Executive of the British Fire Prevention Committee. Record of Congress Organisation, Programme and Resolution.
76. FIRE TESTS WITH DOORS. Two Doors constructed of Deal and covered externally (*i.e.*, "armoured") with Tinned Steel Plates, one hung on hinges and the other made to slide, by the Curfew Armoured Fire Door Company, Manchester. Particulars of Experimental Fire Tests.
77. FIRE TESTS WITH DOORS. Two Doors constructed of Deal and covered externally (*i.e.*, "armoured") with Tinned Steel Plates, one hung on hinges and the other made to slide, by the Curfew Armoured Fire Door Company, Manchester. The Committee's Report.
78. FIRE TESTS WITH FLOORS. A Floor of Concrete Beams reinforced with Iron Rods, by Messrs. Visintini and Weingärtner, Zürich. The Committee's Report.
79. FIRE TESTS WITH FLOORS. A Floor of Karri Wood, by Millars' and Jarrah Forests Ltd. Particulars of Experimental Fire Tests.

B. INTERNATIONAL FIRE PREVENTION CONGRESS, LONDON, 1903. The Official Report, comprising some thirty Papers, etc. With Illustrations.

C. INTERNATIONAL FIRE EXHIBITION, LONDON, 1903. The Official Record. With Illustrations. By EDWIN O. SACHS.

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Publications of the

BRITISH FIRE PREVENTION COMMITTEE—No. 84.

Edited by the Executive.

FIRE TESTS WITH PARTITIONS.

A PARTITION

FORMED WITH

Jabez Thompson's Patent "Terrawode" Brickwood,

AND ERECTED BY

JABEZ THOMPSON,

NORTHWICH, CHESHIRE.

The Committee's Report.

ALL RIGHTS RESERVED.

LONDON, 1904.

PUBLISHED AT THE OFFICES OF

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WESTBOURNE LODGE, BAYSWATER, W.

Offices :

1, WATERLOO PLACE, PALL MALL, LONDON, S.W.
(CHARLES ADAMI, *Assistant Secretary.*)

OBJECTS OF THE COMMITTEE:

The main objects of the Committee are :—

To direct attention to the urgent need for increased protection of life and property from fire by the adoption of preventive measures.

To use its influence in every direction towards minimising the possibilities and dangers of fire.

To bring together those scientifically interested in the subject of Fire Prevention.

To arrange periodical meetings for the discussion of practical questions bearing on the same.

To establish a reading-room, library and collections for purposes of research, and for supplying recent and authentic information on the subject of Fire Prevention.

To publish from time to time papers specially prepared for the Committee, together with records, extracts, and translations.

To undertake such independent investigations and tests of materials, methods and appliances as may be considered advisable.

The Committee's Reports on Tests with Materials, Methods of Construction, or Appliances are intended solely to state bare facts and occurrences, with tables, diagrams, or illustrations, and they are on no account to be read as expressions of opinion, criticisms, or comparisons.

NOTE.

THIS, the first test of a solid brick partition is of exceptional interest. From the large number of extensive fires which have occurred of late, any form of construction which is simple, non-inflammable, and cheap, is to be commended, but the material for internal partitions which fulfils the above requirements is particularly so. Large fires commence as little ones, and if the little ones can be confined within reasonable limits, they will never create the devastation such as occurred at Baltimore. To minimise the quantity of inflammable material in construction should be one of the objects of every architect.

SOTHERAN

MAX CLARKE.

LONDON,

May 25, 1904.

THE GENERAL ARRANGEMENTS FOR TESTS.

(MEMORANDUM.)

THE purpose of the tests undertaken by the British Fire Prevention Committee is to obtain reliable data as to the exact fire-resistance of the various materials, systems of construction, or appliances used in building practice.

The tests are of an entirely independent character, arranged on scientific lines, but with full consideration for the practical purpose in view. Absolute reliability is assured, records being mostly taken automatically, or by photography, and the temperatures being easily regulated by the application of gas.

All reports on tests solely state the bare facts and occurrences, with tables, diagrams, and illustrations, and on no account are reports to be taken as including expressions of opinion, nor should any expression be read as a comparison or criticism.

The general arrangement and direction of the tests are in the hands of the Executive, who act in accordance with certain principles laid down after careful study and experiment. The official tests are attended by the members of the Council and the members of the Committee in rotation.

As to the Committee's present Testing Station, it comprises a house, standing in its own grounds, near Royal Oak Station, and backing on to the Great Western Railway. The principal building is used for Committee Rooms and laboratory purposes, whilst the gardens are utilised for so-called "full-size" tests.

As to the financial aspect of the station, the establishment expenses are being met by a special subscription. As far as the funds of the committee permit, investigations and experimental tests with ordinary (*i.e.*, not patented) forms of construction are undertaken from time to time and duly reported on. Official tests with patented materials, makers' systems, etc., etc., are subject to a scale of charges, but these charges are so figured as to only just cover the actual cost. The Testing Station is also open to members for such private research work or tests they may desire to undertake.

The services of the members participating in the management of the station, conducting or attending tests, are given entirely gratuitously.

For the Executive,

EDWIN O. SACHS, *Chairman.*

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OFFICIAL REPORTS

OF THE

British Fire Prevention Committee

[FOUNDED 1897—INCORPORATED 1899.]

FIRE TEST NO. 50.—MAY 4TH, 1904.

A PARTITION

FORMED WITH

JABEZ THOMPSON'S PATENT "TERRAWODE" BRICKWOOD,

AND ERECTED BY

JABEZ THOMPSON,

NORTHWICH, CHESHIRE.

OBJECT OF TEST.

To record the effect of a fire of four hours' duration at a temperature gradually increasing to 1800° Fahr. (*982·2° C.*), and not to exceed 2100° Fahr. (*1148·8° C.*), followed by the application of water for five minutes on the fire side.

Note.—The area of the partition under investigation was to be at least 75 ft. superficial (*6·97* □ *m.*), with a width of 10 ft. (*3·048 m.*).

Note.—The time allowed for the construction and drying of the partition was to be five weeks.

SUMMARY OF EFFECT.

No effect of the fire was visible on the passage side except the general buckling of the partition and some cracks.

The fire did not pass through the partition.

The recorded temperature in the passage on the outside of the partition at no time exceeded 230° Fahr. (*110·0° C.*).

No effect was caused by the application of water except to flake off the face of five bricks.

DESCRIPTION OF TESTING PLANT.

(*See Figs.* 1 *to* 4.)

The Testing Chamber used was located at the Committee's Testing Station, and was known as "No 2 Hut."

The hut was constructed, as shown, of stock bricks, with lime mortar, and measured 10 ft. by 10 ft. (*3·048* × *3·048 m.*).

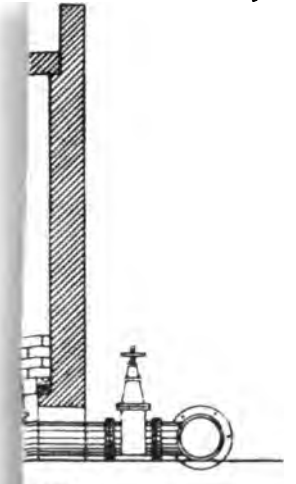
The ceiling was 9 ft. 5 in. (*2·87 m.*) above the pavement of the hut, and was constructed of concrete.

The door, opening in the wall, measured 2 ft. by 6 ft. 6 in. (*·61* × *1·981 m.*), and was open during the test.

The fuel used was gas produced at the station, and the supply was regulated by valves and dampers.

The hut was divided as shown on plan, the partition being constructed from north to south, the full width and height of the hut, leaving the passage on the outside 1 ft. 10 in. (*·558 m.*) wide.

The gas was admitted through two mixing chambers



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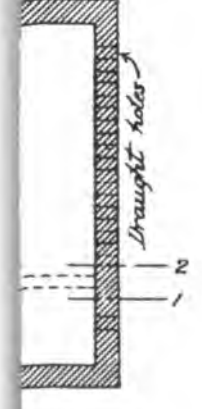

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of fire-brick, each 7 ft. 9½ in. by 3 ft. 3 in. (*2·374* × *·990 m.*) as shown.

Two Roberts-Austen pyrometers were used for recording temperatures, one taking a continuous record from point No. 5, and one being used for the observation records at points Nos. 1, 2, 3, 4. Points Nos. 2, 3, 5 were inside the chamber, and Nos. 1 and 4 outside in the passage.

There were two observation holes, one in the north and one in the south walls, and two small observation holes in the west wall.

The stream of water was applied to the inside face of partition, through the observation hole on the south side, by a branch with ¾ in. (*·019 m.*) nozzle, and supplied from a small steam fire engine, at a pressur of 55 lbs. (*24·95 kg.*) to the square inch.

CONSTRUCTION OF THE PARTITION.

(*See Figs. Nos. 1 to 5.*)

Plans, elevations, and sections of the partition are shown.

On March 29th and 30th the partition was erected.

The bricks forming the partition were built on the floor of the hut, and carried up to the underside of the concrete ceiling, the height of the partition being 9 ft. 2 in. (*2·793 m.*), and total height of hut 9 ft. 5 in. (*2·87 m.*). The partition was 4⅜ in. thick (*·111 m.*), built of bricks 9 in. (*·228 m.*) × 4⅜ in. (*·111 m.*) × 3 in. (*·076 m.*) deep.

The bricks have each two grooves on the face towards passage ⅝ in. wide (*·015 m.*) × ¼ in. deep (*·006 m.*), and a similar groove at one end of each brick.

The partition itself was not plastered on either side.

The partition was built of the bricks, there being 33

courses of the patent bricks resting upon the course of footing bricks, with mortar joints average $\frac{5}{16}$ in. thick (*·008 m.*). The flat face of the bricks was towards the flame inside the hut, these joints being neatly pointed, the general appearance resembling what is known as "fair face." The grooved sides of the bricks were

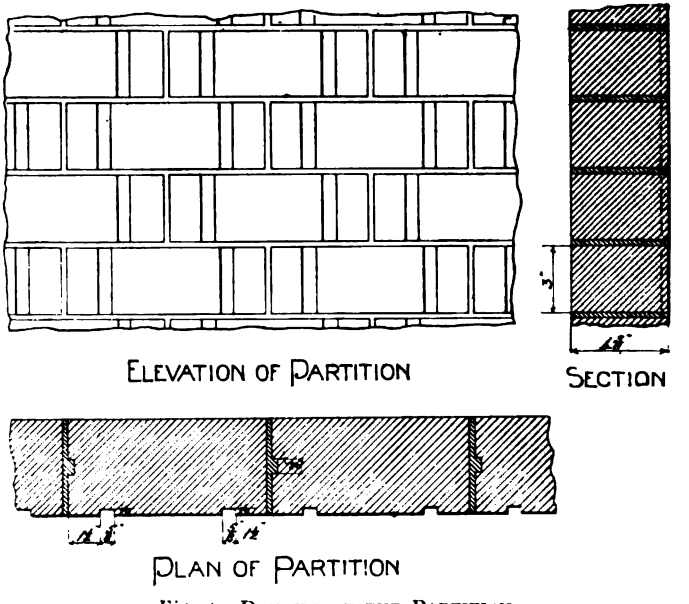


Fig. 5. DETAILS OF THE PARTITION.

towards the outside passage, and presented a rather rough appearance, no attempt being made to point or strike the mortar joints. The partition when built averaged $4\frac{5}{8}$ in. thick (*·117 m.*), owing to the outside face being irregular. The mortar was said by the maker to consist of equal parts of sand, fireclay, and plaster of Paris.

Bricks of the size with which the partition was erected weighed 2 tons (*2,032·1 kg.*) per 1,000.

Fig. 6. VIEW BEFORE TEST (FROM OUTSIDE).

Time : 5.20 *p.m.*

Time : 6.25 *p.m.*

Figs. 7 and 8. VIEWS TAKEN DURING TEST (FROM OUTSIDE).

Fig. 9. VIEW AFTER TEST (FROM OUTSIDE).

On April 25th a coke fire was lighted and kept burning ten hours a day until May 2nd, when it was removed.

THE TEST.

On May 4, 1904, the test was undertaken. The following is a log of the test :—

At 3 p.m. the meteorological observations, taken at the Botanic Gardens, Regent's Park, read as follows :—

"State of weather, cloudy; Wind, N.W.; Barometer, 30·16 inches (·*766 m.*); attached thermometer, 56° Fahr. (*13·33 C.*); Wet Bulb, 56° Fahr. (*13·33 C.*); Dry Bulb, 60·0° Fahr. (*15·5° C.*). Remarks: Fine."

		Minutes Elapsed.
3.15 p.m.	Gas lighted.	0
3.55 p.m.	Steam coming from the joints in some places, both on the inside and outside.	40
4.10 p.m.	Partition buckled inwards towards fire. The greatest deflection was 1 in. (·*0254 m.*), and was opposite to north side of door opening and 3 ft. (·*914 m.*) from floor. Vertical crack appeared opposite to north side of door opening, about 5 ft. (*1·524 m.*) in height, and about centre of total height of partition. A similar vertical crack appeared, 2 ft. (·*6095 m.*) long, about centre of height, and 2 ft. (·*6095 m.*) from south wall.	55
4.15 p.m.	Slight flaking off of the mortar pointing on inside face where the flame struck the partition.	60
4.30 p.m.	Buckling increased to 2½ in. (·*0635 m.*) at greatest, about centre of height, and	

		Minutes Elapsed.
	directly opposite to north side of door opening. The joints on inside next the flame opening slightly about 3 ft. (*·914 m.*) from floor.	75
5.10 p.m.	Joints at bottom of partition outside in passage opposite to south side of door opening, cracked in a diagonal direction upwards towards the south.	115
6.10 p.m.	At the joint, between the 6th and 7th course from bottom, flame was seen from the outside through the joint for a length of 18 in. (*·4571 m.*), the joint being about $\frac{1}{8}$ in. (*·0061 m.*) wide, and also through one small hole in a joint in another place about same width.	175
6.45 p.m.	The greatest deflection from the vertical $2\frac{3}{4}$ in. (*·0698 m.*).	210
7.15 p.m.	The gas was turned off. The fire had not passed through the partition, and the surface on the passage side, except for the buckling and cracks above mentioned, was unaffected by the fire.	240
7.17 p.m.	Water was turned on to the inside face of the partition for five minutes at a pressure of 55 lbs. (*24·95 kg.*) to the square inch. The effect of this was to cause the surface of two bricks and portions of three others to flake off. The water came through the open joint mentioned above, which was just above the bricks the surface of which flaked off. No other effect was visible.	

The temperatures, as read from the observation record off pyrometer points, Nos. 1, 2, 3 and 4, were as follows:—

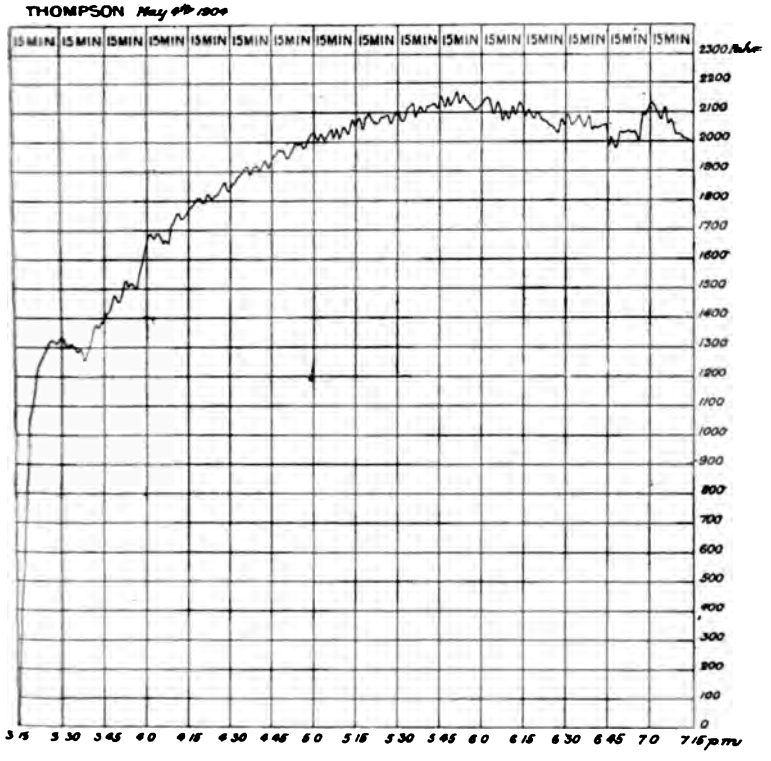
Observations taken from Points Nos. 1, 2, 3, 4.

From 3.15 p.m. to 7.15 p.m.

Time.	Inside.		Outside (in passage).		Minutes Elapsed.
	No. 2.	No. 3.	No. 1.	No. 4.	
	Deg. Fahr.	Deg. Fahr.	Deg. Fahr.	Deg. Fahr.	
3.15 p.m.	—	—	—	—	—
3.21 „	1100	1100	—	—	6
3.27 „	1150	1220	—	—	12
3.33 „	1110	1200	—	—	18
3.39 „	1160	1300	—	—	24
3.45 „	1250	1400	—	—	30
	(676·6 C.)	*(760·0 C.)*			
3.51 „	1345	1445	—	—	36
3.57 „	1565	1580	—	—	42
4.3 „	1550	1550	—	—	48
4.9 „	1660	1660	—	—	54
4.15 „	1720	1680	—	—	60
	(937·7 C.)	*(915·5 C.)*			
4.21 „	1760	1720	—	—	66
4.27 „	1785	1760	—	—	72
4.33 „	1840	1720	—	—	78
4.39 „	1840	1780	—	—	84
4.45 „	1965	1860	—	—	90
	(1073·8 C.)	*(1015·5 C.)*			
4.51 „	1960	1900	—	—	96
4.57 „	1985	1920	180	140	102
5.3 „	1980	1820	150	120	108
5.9 „	2020	1965	185	140	114
5.15 „	2040	1980	—	—	120
	(1115·5 C.)	*(1082·2 C.)*	*(85·0 C.)*	*(60·0 C.)*	
5.21 „	2060	2000	125	120	126
5.27 „	2060	2000	140	120	132
5.33 „	2120	2020	120	100	138
5.39 „	2100	2000	120	140	144
5.45 „	2100	2020	145	120	150
5.51 „	2140	2080	160	150	156
5.57 „	2040	2000	190	160	162
6.3 „	2020	2080	180	170	168
6.9 „	1980	2090	200	190	174
6.15 „	1980	2090	200	200	180
	(1082·2 C.)	*(1143·3 C.)*	*(93·3 C.)*	*(93·3 C.)*	
6.21 „	1980	2100	210	210	186
6.27 „	2000	2060	200	200	192
6.33 „	2000	2060	200	200	198
6.39 „	2000	2080	210	210	204
6.45 „	1940	2000	180	180	210
	(1060·0 C.)	*(1093·3 C.)*	*(82·2 C.)*	*(82·2 C.)*	
6.51 „	2060	2040	210	220	216
6.57 „	2100	2080	220	220	222
7.3 „	2130	2120	210	220	228
7.9 „	2000	2050	220	230	234
7.15 „	1960	2020	220	230	240
	(1071·1 C.)	*(1104·4 C.)*	*(104·4 C.)*	*(110·0 C.)*	

Degrees in italics are in Centigrade.

The continuous record (Point No. 5) read as follows:—



OBSERVATIONS AFTER TEST.

(*Figs.* 6–10.)

On May 6, 1904, the following observations were made:—

On the outside the face presented generally the same appearance as before the test, the buckling was $1\frac{3}{4}$ in. (·*044 m.*) at greatest, and several fine vertical cracks could be discerned, they being of various lengths.

On the inside the partition was curved regularly from top, bottom, and sides to the centre, the flaked bricks,

above mentioned, had the surface off from nothing to 1¾ in. (·044 *m.*) deep. Daylight could be seen through the open joint just above the flaked bricks.

Opposite the S.E. gas jet some of the bricks were vitrified on the surface. Many had small cracks on the surface, the joints in several places were slightly open, but there were no serious cracks and no bricks broken.

The mortar jointing material was slightly vitrified on the surface, as well as the bricks.

GENERAL ARRANGEMENTS.

The test was carried out according to the procedure laid down by the Executive for investigations of this description, and conducted by a Sub-Committee of the Executive, comprising :—

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Mr. J. H. Dyer (Vice-Pres. National Fire Brigades' Union).
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Messrs. T. Kissack and Lister assisted the Sub-Committee.

Mr. H. B. White, M.Inst.E.E., superintended in the Instrument Room.

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Mr. W. Romer (General Electric Co., 1900, Ltd.).

Messrs. Jabez Thompson were represented by :—

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The following visitors attended by special invitation of the Executive :—

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Representatives of the Factory Branch and Theatres Branch of the Architects' Department, London County Council.

Signed,

For the Sub-Committee conducting the Test :

MAX CLARKE (*Directing Member*).

For the General Testing Arrangements Sub-Committee :

ELLIS MARSLAND.

For the Executive :

EDWIN O. SACHS (*Chairman*).

Published by the Committee as directed by the Executive.
CHARLES ADAMI
(*Assist. Secretary*).
Date—May 30th, 1904.

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dited by the Executive.

FIRE PROTECTION ON BOARD SHIP

BY

EDWIN O. SACHS,

A.Inst.M.E., A.Inst.N.A.

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LONDON, 1904.

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OBJECTS OF THE COMMITTEE:

The main objects of the Committee are :—

To direct attention to the urgent need for increased protection of life and property from fire by the adoption of preventive measures.

To use its influence in every direction towards minimising the possibilities and dangers of fire.

To bring together those scientifically interested in the subject of Fire Prevention.

To arrange periodical meetings for the discussion of practical questions bearing on the same.

To establish a reading-room, library and collections for purposes of research, and for supplying recent and authentic information on the subject of Fire Prevention.

To publish from time to time papers specially prepared for the Committee, together with records, extracts and translations.

To undertake such independent investigations and tests of materials, methods and appliances as may be considered advisable.

The Committee's Reports on Tests with Materials, Methods of Construction, or Appliances are intended solely to state bare facts and occurrences, with tables, diagrams, or illustrations, and they are on no account to be read as expressions of opinion, criticisms, or comparisons.

The Committee is not responsible for the views of individual authors as expressed in Papers or Notes, but only for such observations as are formally issued on behalf of the Executive.

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Sub-Committees comprise Members of the Executive with Assistance from the General Membership.

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NOTE.

The terrible loss of life at New York in connection with the burning of the excursion steamer, "General Slocum," should serve to remind those interested in the design and construction of our mercantile vessels that the danger of fire on board ship does not receive the attention which I have long deemed necessary.

This fire, it is true, occurred in peculiar circumstances, and, as has lately been frequently the case with fires on the American Continent, showed that unfortunate combination of untoward circumstances, arising mainly from neglect of common precautions and the evasion of official requirements, for which the United States has an unenviable reputation.

It is improbable that such a combination of all that is contemptible in the management of a ship, with all that ignorance and negligence could bring about, could occur on a British ship, however antiquated or badly found.

Nevertheless, the fire hazard on board British ships is very real, and the ratio of risk increases with the greater tonnage and greater speed obtained in ocean greyhounds and passenger boats, and greater protection from fire on board ship is a necessary requirement that must be systematically met and dealt with as a problem of humane and economic interest requiring immediate solution.

We should let this sad example at New York serve us as the object lesson that is apparently always needed to bring about improvements in matters appertaining to safety from fire.

To wait for some sad object lesson off our own shores or on a vessel sailing under our own flag would surely now also put our shipping authorities in a very awkward position. If the shipping authorities, the shipowners, shipbuilders, and the underwriters will, however, work hand-in-hand, much can be done to improve on matters as they now stand, without entailing much hardship upon the vested interests concerned.

As a basis for discussion, I have compiled in note form what I consider essential for Fire Protection on Board Ship. These notes comprise, in somewhat revised and elaborated form, the principles I put before the Institution of Naval Architects in a paper prepared and read during the Spring Session of this year.

On that occasion, I specifically mentioned that I scarcely thought much would be done to improve matters unless some calamity occurred involving many hundred lives. Such a calamity has now unhappily occurred, but I trust it will serve to bring about the adoption of such measures as are necessary to avoid the possibility of such a terrible loss of life again taking place.

EDWIN O. SACHS.

LONDON, S.W.
June 24th.

Fire Protection on Board Ship

BY

EDWIN O. SACHS,

A.Inst.M.E., A.Inst.N.A.

In presenting this paper, dealing with fire prevention on board ship, I am guided solely by the view that the subject—although of eminent importance to the safety of human life, and of very considerable interest from an economic point of view—has not yet received the attention it deserves from shipowners, shipbuilders, underwriters, or, as a matter of fact, from the public authorities controlling our maritime affairs. I am under the impression that by bringing forward the subject at this meeting my remarks may serve as a reminder to all concerned, that the time has come to give the matter that systematic and earnest attention which is being accorded to many other departments not only relating to the administration of our shipping interests and the building of new tonnage, but also tending to the comfort and safety of the passengers and crew, while lessening the ordinary economic risks of navigation.

Being an architect, as distinct from a naval architect, I naturally approach the subject entirely from the landsman's point of view. My profession makes me look upon ships much as I would upon buildings, and classify the fire risks of our great commercial fleets

much as I would separate the different classes of business premises on land.

Ships used exclusively or mainly for passenger trade, ships that solely or mainly carry cargo, and ships that carry both passengers and cargo, stand in my mind as the three great divisions of commercial shipping, as seen from the fire risk point of view. The ship which serves the passenger trade, and on which passengers congregate in large numbers, stands in the same place for me as the building in which the public are allowed to assemble, be it hotel, common lodging-house, or place of public entertainment. The cargo boat may be looked upon as a building belonging to the warehouse class, whilst the boat which carries both cargo and passengers may be looked upon as a tenement building, which is partly used as a warehouse, or *vice versâ*, a combination which figures largely in the building problem on shore.

As far as these three classes of tonnage are concerned, the passenger boat is of primary importance to the community at large, for the fire risk here involves the public safety. Where economic interests are involved, the cargo boat probably takes the first position, more particularly where underwriters are concerned, whilst the combined class compels both an active humane as well as an active economic interest.

In respect to the safeguards that call for consideration in these three classes of tonnage, they may be divided, as on shore, into (*a*) constructional safeguards, (*b*) safeguards in equipment, (*c*) administrative safeguards, and (*d*) safeguards in fire extinguishing. All these forms of safeguard should be applied to our shipping, each varying in importance with the individual class of tonnage.

Constructional Safeguards.

Design.—Regarding the constructional safeguards, I consider the primary safeguard in design to be the one

which is now being generally adopted on land, namely, that of dividing the ship into the maximum number of fire-resisting compartments. This division, for the purpose of reducing possible fire risks, must be more extensive than that of the compartment system already in general use for the purpose of dividing the ship into water-tight compartments. It will be found easier to divide the ship into fire compartments that may be deemed individual fire risks, rather than into the water-tight compartments generally associated with shipbuilding designs. The divisional lines of the water-tight compartments will necessarily serve as a basis for the fire-resisting compartments, but the latter should be the more numerous. The horizontal division of a fire-resisting character does not bring with it any great technical difficulties. The subdivision of the hold into smaller compartments than the usual subdivisions is of little difficulty and inconvenience in the majority of cases. Having special regard to the passenger boat, there is not the slightest reason why the long flights of cabins and saloons should not have more frequent subdivision, if only by means of non-inflammable, hard-wood bulkheads, than is usually effected by water-tight doors.

The primary safeguard against spread of fire in ships of all classes will be their division into the largest number of small fire risks consistent with the work of the ship, and this number can and should far exceed the number of divisions made in order to obtain water-tight compartments.

Materials.—Turning next to the safeguards in the application of materials to the construction of vessels, I consider the reduction of combustible material to a practical minimum to be essential. For the passenger ship, however, in particular, I would go so far as to say that the reduction of the combustible material should be compulsory, and that, above all, the vast quantities of

highly inflammable wooden partitions and fittings used on board our ocean greyhounds and excursion steamers should be absolutely condemned. There is not the slightest reason why wood should be used at all to the extent that it is at present, for with metal framing and the various forms of sheeting of a non-inflammable character (the component parts of which are, to a large extent, asbestos) a very considerable amount of the woodwork would, *ipso facto*, be banished, to the advantage of all concerned, for these sheetings economise space, and are excellent non-conductors where hot summer weather is met with or climatic changes are encountered.

That wood, however, will always be necessary on board ship to some considerable extent, I do not wish to dispute; but where such wood is really necessary to the comfort of passengers, why not use wood that has been impregnated so as to make it "flame-proof," or what is more colloquially known as "non-inflammable"? In the same way as the New York Building Department requires the wood furnishings and fitments of the upper portion of any skyscraper to be of "non-inflammable" wood, and just as our own County Council requires all furnishings in theatres to be rendered and maintained "non-inflammable," so for ships used mainly or entirely for general, passenger, or excursion service, the amount of highly inflammable woodwork at present to be found should be prohibited in the interests of the safety of the passengers. No doubt proposals of this kind will be met to-day with the same scoffing and opposition as new safeguards generally meet with in the first instance. As far back as 1895, I strongly advocated that "flame-proof" materials should be made compulsory in theatres, but it required the Chicago Theatre fire, with a loss of some six hundred human lives, to wake up our public authorities in London to the importance of this matter of non-inflammability, and it is only a few months back

(February, 1904) that we find London adopting the proposals. Are we to wait until one of our ocean greyhounds, or an excursion steamer on the Thames burns, with a loss of many hundred souls, before this provision is made compulsory? Surely the burning of the excursion steamer "General Slocum" off New York City should serve as a sufficient object-lesson how rapidly the ordinary wood top-hamper of a vessel will burn when a fire gets well started. Surely, too, it would be better for the shipowner who is laying down new ships to specify of his own accord what is necessary. Otherwise, one of these days, after some great catastrophe in our midst, he may find himself confronted, not only with legislation regarding his future ships, but with retrospective requirements in this direction, and the latter will be the more awkward condition of the two to meet.

The "non-inflammability" of wood is a problem which, to my mind, has been solved commercially. I have gone into the matter most carefully, and base this finding, not only on English, but on American and Continental experience. Such tests as those before the British Fire Prevention Committee at our Testing Station, as reported upon in Publications Nos. 36 and 57, quite converted me from the somewhat sceptical attitude which I took up regarding the earlier demonstrations of the utility of impregnation. I can, however, foresee that the foremen or workmen in the shipyards may put forward all manner of excuses as to the unsuitability of treated wood for shipbuilding, for to my mind it must be slightly harder to work and require additional "elbow-grease"; but the fact remains, that the earlier difficulties have been overcome, and that both in England and in the United States wood can be treated, which is in every way perfect, will take paint, will not corrode nails, and will not contain any poisonous chemical; and thus the more intelligent naval architect and shipyard manager will, if he so wishes

merely have to combat the ignorant prejudice of his subordinates—at the most a matter of months. Fortunately, too, the impregnation of wood, with the view of making it "flame-proof," is no longer the monopoly or speciality of the United States, where, I understand, some half-dozen firms are already undertaking work of this kind; but similar firms are now at work or starting work in Great Britain, France and Germany. Hence, suitably treated wood is now obtainable commercially on this side of the Atlantic.

What refers to woodwork on the passenger ship, refers in some degree to textiles, but not to the same extent, as it is well known that the proportion of textiles on board ship is quite minimal.

As to the cargo boat, the large amount of wood at present to be found on board is, to a great extent, quite unnecessary, and, although I will not go so far as to say that "non-inflammable" wood should be compulsory on a cargo boat, I believe it would be in the interests of shipowners to reduce the amount of wood to a minimum, and to lessen the fire risks in the crew's quarters and officers' cabins by using treated wood in these parts.

Where the difficulty really arises, however, is to find the happy medium for ships which are a combination of cargo and passenger boat. A practical compromise can be arrived at by defining the safeguards I advocate for cargo ships which have accommodation for more than a certain number of passengers.

Safeguards of Equipment.

The two forms of equipment safeguards to which a great deal more attention should be paid, are: (1) the protection of the hot steam piping, and (2) careful electric wiring.

The Steam Pipe.—Regarding the hot steam pipe, its protection in many instances is quite insufficient, particu-

larly on what I will term the cheaper class of boat, *i.e.*, the minor passenger boat and the minor cargo boat. The result is that the hot steam pipe is frequently the cause of outbreaks of fire, afterwards attributed to spontaneous combustion or climatic conditions. I advocate that the steam pipe should have additional protective, besides its ordinary insulation covering, in the form of a wire guard in all exposed places, so that anything lying right up against it does not touch the pipe or pipe coating, *i.e.*, that there is an air space intervening.

Electric Wiring.—It would lead too far to go into the details of electrical wiring, but I cannot but call attention to the fact that, as far as the electrical risk on land is concerned, the Chicago Theatre Fire, the Metropolitan Railway Fire in Paris, and the great Buda-Pesth Warehouse Fire—all within the past twelve months—are attributable in the first instance to electrical causes. It is, of course, true that many other forms of neglect combined to turn these electrical accidents into catastrophes. At Chicago, for instance, the electrical accident itself was a very minor one, but the great amount of inflammable material on the stage of that theatre turned that accident into a catastrophe. I fully realise that the electrical risk is not as great as that of the open light, but the danger is a hidden one, and hence of a very treacherous character. Any scamping in the electrical installation on board ship should be made impossible, and greater supervision in this respect on board ship—and particularly on passenger vessels—is essential.

Administrative Safeguards.

The administrative arrangements for handling and storing cargo on board ship are by no means as perfect as they should be from the fire point of view. It depends almost entirely on the individual initiative and

good sense of some subordinate as to whether the necessary precautions are taken.

Spontaneous Combustion.—Here, again, it would lead too far to discuss the many problems of spontaneous combustion, or alleged spontaneous combustion, on board ship, for that term frequently covers a multitude of other sins. But there is no doubt that spontaneous combustion plays an important *rôle* in the annals of our ship fires, and that this spontaneous combustion is mainly due to administrative neglect. It would be well if some technical body interested in the subject, such as the British Fire Prevention Committee, were to collate the actual experience obtained of ship fires caused by spontaneous combustion, and further collate the various safeguards against spontaneous combustion in a short and practical form, for distribution among shipowners and such of their officials as have to do with the loading of vessels. The Committee is at present forming an industrial section, and, given the necessary funds, it has all the material at hand, and the voluntary workers, to get a matter of this kind attended to. At present, as I have said above, it depends mainly on individual initiative and on rule of thumb, as practised by some subordinate, whether the stowage has been carefully undertaken or not, from the fire point of view; and this haphazard way of dealing with an important element of danger should be stopped.

Patrols.—This question of stowage and spontaneous combustion is, of course, of primary importance to the cargo boat, or to a ship that combines cargo with passenger traffic. It is also of some importance in the passenger boat. In all classes of ships, however, I consider that there should be the safeguard of a fire patrol—as practised on land in the Liverpool warehouses, with regular inspection—more particularly in the holds and out-of-the-way corners of the ship. The

additional trouble thereby involved should not be shirked. The patrol is an all-important administrative safeguard.

The patrol's work should be supplemented by an ordinary electrical fire alarm or telephone system, and in numerous cases where particularly hazardous cargoes are carried a small, reliable, automatic fire alarm, on a closed electrical circuit, will be found a useful auxiliary.

I may, of course, hear the question asked: Why all this effort? My answer is, that if life is saved by the effort of careful administration, this should recompense the shipowning community as a whole for the trouble taken. But apart from any question of human life, the *bonâ fide* fire on board ship is always a matter of considerable inconvenience and loss to the shipowner, for which no underwriting money can, as a rule, compensate him. For a passenger line, in addition, the slightest outbreak of fire generally serves as a very injurious advertisement. Besides this, there is the annual national fire waste to be considered, by no means a small factor in the economy and prosperity of the British Isles.

Rules.—Of administrative safeguards on board ship, there are numerous other ones which refer to the rules for the crew and the passengers, and particularly steerage passengers. These regulations are, as a rule, carefully drafted and closely adhered to on most of the great liners sailing under the British flag, but I think that there are yet a number of safeguards that might be defined in form of rules, without causing inconvenience.

On board passenger ships, one of the most common abominations, from the fire point of view, is the passenger who after "lights out" reads by candle light in his bunk, and, what is more, often goes off to sleep, leaving the candle burning. A light in the cabin after regular hours should involve immediate inspection by whoever is on patrol duty, and dangerous open lights such as these should be prohibited.

Fire Extinguishing.

The arrangements for getting the men together to extinguish a fire on board a British ship, *i.e.*, the calls to fire quarters, are generally good and smartly executed, but there is not much to be said in favour of the fire service equipment. Only last year, on an ocean liner of the first order, I was absolutely astounded at the inadequacy and elementary character of the fire service equipment.

Hand-pumps, Hydrants, &c.—For the ordinary small fire on board ship, nothing is more in place or more effective than the ordinary bucket and hand-pump. The next thing which should be remembered is that a hydrant, to be effective on board ship, must stand charged at a fair pressure of, say, two atmospheres, and be so placed and connected up that it can be immediately brought into action. Pumping water at high pressure is not of such importance during the first few minutes as an efficient stream at a fair pressure, immediately applied without fuss or trouble.

Steam-pumps, &c.—Steam-pumps will, of course, be found ready for action on any decent ship nowadays, but really strong and efficient manual engines should also be placed in positions where a large number of men can easily get at and efficiently handle them. These would be reliable stand-bys. The inefficient squirty manual of an antiquated type is all too common, and, I believe, still meets the requirements of our shipping authorities. Attention should be paid to matters of detail, such as good either-end couplings and good unlined canvas hose. In all ships the hand-pump and hydrant should be accorded premier importance.

Gas.—On the cargo boat, however, and on the combined boat, the fire-extinguishing equipments should compulsorily include an extinguishing plant for the application of gases suitable for fire extinguishing.

This form of extinguishing is most effective, but it must not, of course, be considered as entirely replacing extinguishing by water; inasmuch as it will not always entirely extinguish the fire, but only keep it down. A fire, thus having had its back broken by the gas, still generally wants handling with water, and there are many points in a ship quite unsuitable, to my mind, for the application of gas, which is mainly intended for use in the holds.

Fire Quarters.—I need hardly say that "fire quarters" require careful thinking out and arranging to meet individual cases, and that no hard-and-fast rule can be laid down as to the number of men or their stations, except that a few men should always be kept at hand, close to the bridge, to go anywhere and do anything where special assistance is required, and that this squad of special service men stationed near the bridge should be athletic unmarried men. Much depends on the selection of the right men for the different duties on the "fire quarters" schedule. Further, fire quarters should be frequently practised, and the great shipping lines should encourage smartness and efficiency in this direction by awarding cups or prizes for special drills, such as the rapid running out of hose, etc., after the manner of the private fire brigades on shore. It would also be of considerable benefit if the officers were encouraged to acquaint themselves with the leading principles of fire fighting, and fire tactics, and more particularly with the handling of fires occurring in special classes of goods, such as cotton, jute, tobacco, etc.

Expense.

Having given my views on these various safeguards, I shall, of course, be immediately confronted with the question of expense thereby incurred. I do not think

the additional expense to be considerable, but even if there be some additional capital outlay in the first instance, the loss of interest thereby involved should be partly made up by a reduction on the underwriting rates, both as to the ship and as to its cargo. The additional division into compartments is not a great expense. The application of non-inflammable materials, though at first sight an apparently heavy item, involves but a very small percentage on the total expenditure of furnishings and fitments in an up-to-date passenger ship. The expense for the administrative safeguards is minimal, and that for the fire-extinguishing equipment likewise. In fact, if only shipowners and shipbuilders would take the matter to heart, they would find that the moment they really wished to make their vessels safer from fire, they would be able to do so at a very small cost; whilst, of course, as long as they look upon the safeguards with disfavour, the extra expense will be described as "enormous," and they will only be applied under compulsion.

Men-of-War.

It will be noticed that the whole of the ships I have dealt with are ships of peace and commerce. I have purposely not touched upon the question of war vessels, as I wish to defer special reference to this side of the subject until authoritative technical reports are available on the happenings in the Russo-Japanese war. Some of our ships of peace, *i.e.*, our rapid liners, are, however, probably to become auxiliary cruisers, or transports, so that apart from any question of vessels specifically constructed as fighting ships, all that has been said regarding fire protection for the ocean greyhound will have a very special bearing on these ships in time of war, and be of advantage to the nation.

The matter of fire protection on our liners must, I hold, be a very serious one for our Naval organisation,

particularly as the modern practice of commencing hostilities before the actual declaration of war limits the time available for special preparations both on auxiliary cruisers or transports.

But, as I have indicated, I do not desire to go into detail on this subject, but merely again to bring the issues to the particular notice of those responsible for the arrangements governing the possible use for naval purposes of ships of the mercantile marine.

CONCLUSION.

In conclusion, I would emphasise the fact that these remarks are only intended to serve as an outline of the principal points for consideration in this very important and much-neglected subject, and I trust it will lead to an improvement in our safeguards against fire on board ship.

That, apart from the terrible catastrophe off New York, fires on board ship constantly occur, and, what is more, occur with increasing frequency, no one will deny; and I am afraid that many a fire at sea has been hidden from the world by that terrible word "missing," to be found all too often in the shipping records. As to the past year, 1903, I would add that, according to Mr. Harold Sumner, of the Liverpool Underwriters, there were over 300 fires on record for the past twelve months, in ships of over 500 tons register. Of these 108 were serious. I append a detailed list as to their character and the tonnage involved, from which it will be seen that many large ships are included, and many of them are of the most modern types. Such figures and facts speak for themselves, and at the same time will, I trust, prevent any one from thinking that a ship's fire at sea is a rarity, and the subject of fire protection on board ship a matter of too small humane and economic importance to merit attention and systematic effort.

FIRES IN MERCHANT VESSELS, 1903.

THE FOLLOWING IS A LIST OF IMPORTANT FIRES WHICH OCCURRED DURING THE YEAR 1903.

BRITISH STEAMERS.

DATE.	VESSEL.	TONS GROSS.	YEAR BUILT.	MATERIAL	VOYAGE.	CARGO.	PARTICULARS.
Jan.	**Banca**	5,995	1900	Steel	London—Yokohama	General	Fire broke out at sea, considerable damage resulting.
,,	**Clan Alpine**	3,587	1899	Steel	At Dundee from Chittagong	Jute, &c.	Fire No. 4 hold, 600-700 bales jute damaged.
,,	**Manchester Merchant**	5,057	1900	Steel	New Orleans—Manchester	Cotton, grain, resin, and lumber.	Scuttled, Dingle Bay, total loss.
,	**Sagami**	4,212	1902	Steel	Norfolk, Va.—China	General, including cotton, petroleum (acids carried on deck).	Put into Cadiz, serious fire in cargo.
,,	**Egremont Castle**	2,946	1890	Steel	Algoa Bay—Colombo	.....	At Seychelles, bunker cargo on fire, had been burning 15 days.
Feb.	**Jessie Burns**	3,445	1901	Steel	At Bremen from Savannah	Cotton, &c,	Fire on board, 150 bales cotton damaged.
March	**Montreal**	Completing at Toronto			.....	.....	Destroyed by fire.
,,	**Hilltarn**	3,549	1899	Steel	Calcutta—New York	General	At Port Said serious fire on board.
,,	**Knight Errant**	7,464	1898	Steel	Bombay—Antwerp	General	Arrived Suez, cargo No. 3 hold on fire amongst seeds and cotton.
April	**Crown Point**	5,219	1900	Steel	Philadelphia—London	General	At St. John's, N.F., cargo forehold on fire.
,,	**Pekin**	3,957	1888	Steel	At Kobe for Bombay	.....	Took fire in port, damage estimated £1,500.
May	**Dewsland**	1,993	1883	Iron	At Almeria	Loading esparto grass	Considerably damaged by fire.
June	**Formosa**	4,045	1892	Steel	At London from Yokohama	General	On fire, main hold and contents (cocoanut oil, &c.) seriously damaged.
,,	**Pindari**	5,713	1891	Steel	At Calcutta for Dunkirk	Wheat, jute, &c.	Serious fire No. 4 hold.
July	**Jason**	7,450	1902	Steel	At London from China and Japan.	Jute, plumbago, &c.	Serious fire cargo, 1,500 bales damaged.
,,	**Heathford**	3,767	1901	Steel	Shanghai—New York	Valuable general	Arrived Colombo, cargo on fire, No. 2 hold, badly damaged.
,	**Karamea**	5,564	1899	Steel	At London for Wellington, N.Z.	General	Fire in cargo, considerable damage resulting.
,,	**Craigellachie**	3,497	1900	Steel	River Plate—Hamburg	Grain	Fire in cargo, No. 3 hold.
,,	**Roseley**	4,370	1902	Steel	At Port Elizabeth from New York.	.....	Bunker coal on fire, serious damage to cargo.
,,	**Mayfield**	1,249	1877	Iron	At Carthagena from Blyth	Coal	Fire in No. 2 hold and starboard bunker, considerable damage.
Aug.	**Algeria**	4,510	1891	Steel	At Leghorn	.....	Fire in bunkers, extensive damage to ship.
,,	**Indrawadi**	5,104	1902	Steel	At Singapore	Tea, &c.	Serious fire in cargo, 1,400 tons tea damaged.
,,	**Baluchistan**	2,746	1897	Steel	London and Manchester for Bussorah.	General	Arrived Bushire, cargo on fire, forehold almost all damaged.
,,	**Cousins Arbib**	2,163	1882	Iron	Agullas—Methil	Esparto grass	Arrived Gibraltar, cargo on fire, vessel beached, serious damage to ship and cargo.
,,	**Thurland Castle**	3,819	1901	Steel	Galveston—Antwerp	Cotton, &c	Had fire in coal bunkers, which lasted five days.
Sept.	**Hilarius**	3,147	1894	Steel	At Bombay loading for Europe.	.....	Took fire in port, vessel beached, 4,000 tons cargo on board, of which 1,200 tons destroyed, balance nearly all damaged.

Date.	Vessel.	Tons Gross	Year Built.	Material.	Voyage.	Cargo.	Particulars.
Sept.	**Pilbarra**	2,664	1897	Steel	At Melbourne from Sydney	General (including nitre)	Took fire in port, serious damage.
,,	**David Weston**	795	1866	Wood	At St. John, N.B.	.....	Destroyed by fire.
,,	**Umkuzi**	2,057	1890	Steel	At Calcutta loading for Cape	General	On fire No. 2 hold, serious damage cargo, and Nos 1 and 2 'tween decks.
Oct.	**Bida**	1,477	1901	Steel	Lagos—Hamburg	Palm oil, &c.	Abandoned on fire, North Sea.
,,	**Celtic**	20,904	1901	Steel	At Liverpool from New York	General	Fire No. 4 hold, wherein was stowed cotton, wood pulp, leather, bulk more or less damaged.
,,	**South America**	4,197	1900	Steel	At Dundee from Calcutta	Jute	Fire No. 2 hold, cargo badly damaged.
,,	**Ovalau**	1,229	1891	Steel	Norfolk Island—Sydney	Copra, &c.	Destroyed by fire, Lord Howe Island.
Nov.	**Halizones**	5,093	1902	Steel	River Plate—Liverpool	Maize, &c.	Put back Monte Video, bunker coal on fire, part cargo damaged.
,,	**Serapis**	1,904	1877	Iron	Genoa for London and Antwerp.	General	On fire after holds at Naples, considerable damage.
,,	**Hastings** (steam-boat)	...	...	...	At Naraingang (near Calcutta)	Jute	Scuttled on fire, 5,300 bales jute lost.
,,	**Madura**	4,484	1901	Steel	Barry—Buenos Ayres	Coal	Put back on fire, port side vessel gutted.
,,	**Veria**	3,229	1899	Steel	At Alexandria from Venice	Hemp	Took fire in port, 480 bales hemp damaged, also some jettisoned.
,,	**Jerseymoor**	3,746	1901	Steel	At New Orleans	Part loaded cotton	Fire in forepeak, 300 bales cotton damaged.
,,	**Tyne**	2,902	1900	Steel	Middlesboro' and London for Santos.	Jute, &c.	Fire No. 4 hold, serious damage to cargo.
Dec.	**Assiout**	3,146	1889	Steel	At Alexandria for Liverpool	Cotton	Fire Nos. 1 and 2 holds, 1,000 bales cotton damaged.
,,	**Ravenna**	1,243	1883	Steel	Leith—Norresundby	Coal	Arrived Aalborg on fire, cargo seriously damaged.
,,	**Torr Head**	5,011	1894	Steel	New Orleans—Belfast	Cotton, &c.	Fire No. 2 hold, quantity cotton damaged.
,,	**Vauxhall Bridge**	3,391	1901	Steel	At Calcutta, loading for Bombay.	.....	Coal No. 3 hold and bunkers on fire extensive damage hull and engine room.
,,	**Lady Joicey**	3,104	1898	Steel	W.C.S. America—Savannah	Nitrate	Destroyed by fire.
,,	**Cygnet**	2,012	1883	Steel	London—Leghorn	General	Destroyed by fire.

BRITISH SAILING VESSELS.

Jan.	**Glenesslin**	1,818	1885	Iron	At Astoria for Delagoa Bay	Flour	Fire on board, much damage to cargo, vessel also injured.
,,	**Veronica**	1,167	1879	Wood	Ship Island to Buenos Ayres	Timber	Destroyed by fire (incendiarism).
March	**Procyou**	2,122	1892	Steel	At Greenock from San Francisco	Grain	Took fire in port, vessel and cargo badly damaged.
May	**Saragossa**	2,503	1902	Steel	Liverpool—Sydney	General	Fire broke out on passage, cargo forehold damaged.
,,	**Clan Galbraith**	2,149	1894	Steel	At Cardiff	.....	Main hold on fire, serious damage vessel.
June	**Durham**	2,093	1874	Iron	Buenos Ayres—Melbourne	.....	Vessel and cargo seriously damaged by fire in Buenos Ayres roads.
Aug.	**Earl of Dunmore**	2,287	1891	Steel	At Sydney from London	General	Took fire in port, vessel beached, quantity explosives discharged before fire.
Oct	**Albretina**	701	1890	Wood	Annapolis, N.S.—Monte Video	Deals	On fire at Halifax, seriously damaged.
Dec.	**Clydesdale**	1,041	1895	Steel	At Tocopilla	Part loaded nitrate	Destroyed by fire.

FOREIGN STEAMERS.

DATE.	VESSEL.	TONS GROSS	YEAR BUILT.	MATERIAL.	VOYAGE.	CARGO.	PARTICULARS.
Jan.	**Dordrecht**	2,151	1899	Steel	Pensacola—Bremen	Cotton, &c.	Cargo on fire forehold, serious damage.
,,	**Hilma Bismark**	716	1896	Steel	Hamburg—Malmo...	General including cotton	Serious fire in deck cargo, cotton, extensive damage.
,,	**Salak**	2,519	1891	Steel	Batavia—Rotterdam		Put back Port Said, cargo on fire.
,,	**La Touraine**	9,047	1890	Steel	At Havre for New York ...	General	Vessel seriously damaged by fire.
March	**Helena**	1,146	1899	Steel	Amsterdam—Lisbon	General	Put into Portland Roads, fire in after hold, cargo badly damaged.
,,	**Theodor Wille**	3,667	1901	Steel	Zebu—Hamburg	.....	Fire broke out at sea, part cargo jettisoned.
April	**Olympia**	2,837	1883	Iron	At Hong Kong	.....	Fire on board, forepeak badly damaged, cargo forehold damaged.
,,	**Madrileno**	2,990	1890	Steel	At Port Arthur (Tex.) for Liverpool.	Cotton, &c.	Serious fire in cotton, 300 bales fire and 700 bales water damaged.
,,	**Guadalquiver**	2,658	1888	Steel	At Salonica	.....	Boiler exploded, causing fire, steamer almost totally destroyed.
May	**Hyades**	3,753	1900	Steel	At Hong Kong for Tacoma ..	.....	Seriously damaged by fire.
June	**Pfohl**	760	1868	Wood	On Lake Huron	Coal	Destroyed by fire.
,,	**Marie Paulig**	1,520	1881	Iron	Antwerp—Cronstadt	General, including cotton	On fire at sea, 300 bales cotton jettisoned, 100 bales damaged by fire and water.
,,	**Rijnland**	4,155	1900	Steel	Amsterdam—Buenos Ayres .	General	Fire No. 4 hatch, considerable damage.
,,	**Empire State**	1,116	1862	Wood	In dock at Kingston (O.) ...	.....	Badly damaged by fire.
,,	**Venus**	4,051	1891	Steel	Trieste—Genoa	Tallow and cotton... ...	Vessel and cargo seriously damaged by fire.
July	**Maria Madre**	1,877	1878	Iron	At Antwerp	Loading turpentine, &c.	Fire confined to deck, which sustained heavy damage.
,,	**Manchuria**	6,193	1900	Steel	Shanghai and Bombay for Havre	Wheat, rapeseed, copra, cotton, &c.	At Port Said, cargo on fire, serious damage ship and cargo.
,,	**Juan Cunningham** ...	1,138	1883	Steel	Antwerp—Spain	General	At Corunna, cargo on fire, vessel beached.
,,	**Caprera**	Under	construction at		Palermo	.....	Badly damaged by fire.
Aug.	**Kawachi Maru**	6,009	1897	Steel	Japan—Marseilles, &c.	Copra, hides, &c.	Arrived Messina, cargo on fire.
,,	**Tonkin**	6,364	1898	Steel	Marseilles—Yokohama... ...	General	At Kobe, serious damage caused by fire following explosion of chlorate of potash.
,,	**Pittsburg**	1,349	1871	Wood	At Sandwich (O.)	.....	Burnt to water's edge.
,,	**Amiral Gueydon**	5,417	1901	Steel	Havre—Cochin	General	Explosion on board, causing fire, vessel beached, Arabian Coast, seriously damaged.
Sept.	**Klampenborg**	1,785	1889	Steel	Blyth—Cronstadt	Coal	Abandoned on fire, afterwards towed Grimsby.
,,	**Vaskapu**	1,709	1891	Steel	At Bourgas	.....	Explosion on board, causing fire, forepart and cargo destroyed.
,,	**Excelsior**	830	1893	Wood	Seattle—Valdez	Coal, &c.	Beached, Wrangel Narrows, on fire, cargo almost entirely destroyed.
,,	**City of Everett**	2,504	1894	Steel	At Port Arthur (Tex.) for New York	Oil	Took fire from explosion, vessel seriously damaged, dock entirely destroyed.
,,	**Hermine**	3,799	1900	Steel	New Orleans—Trieste	Cotton, &c.	Had fire on passage, 800 bales cotton damaged.
Oct.	**Erica**	1,893	1896	Steel	Wilmington—Liverpool ...	Cotton	Put into Norfolk, cargo on fire

FOREIGN STEAMERS—*Continued.*

Date	Vessel.	Tons Gross.	Year Built.	Material	Voyage.	Cargo.	Particulars.
Oct.	**Tjilatjap**	3,859	1903	Steel	Samarang—Japan	Sugar	Cargo, forehold, badly damaged by fire.
,,	**Advance**	1,178	1900	Comp.	Montreal—Fort William ...	General	Scuttled, Sault Ste. Marie (Mich.).
,,	**Manhattan**	1,545	1887	Wood	Duluth—Sandusky	Wheat	Destroyed by fire, Lake Superior.
Nov.	**Argentino**	3,618	1895	Steel	Buenos Ayres—Marseilles ...	Maize	Had fire on board—damage not reported.
,,	**Pallanza**	4,572	1891	Steel	Newport News—Hamburg ...	Cotton, &c.	At Portland (Dor.), cargo on fire, forehold, which contained cotton, oil, walnut logs, &c., cargo badly damaged.
,,	**Atlantic**	683	1883	Wood	At Cleveland	.....	Destroyed by fire.
,,	**Bormida**	2,304	1884	Iron	Leghorn Naples	Silk, coffee, and grain ...	Seriously damaged by fire near Porto d'Anzio, 400 tons cargo destroyed.
,,	**Alesia**	5,167	1896	Steel	Hamburg China	General	Arrived Port Said, cargo on fire, forehold.
,,	**Minnesota**	1,138	1880	Wood	.....	Coal	Destroyed by fire, St. Clair River.
,,	**Monroe**	4,704	1902	Steel	.....	.....	Arrived New York, fire in hold.
,,	**Arnold Snyken**	1,742	1888	Steel	Singapore—Tientsin	Case oil	Abandoned on fire.
Dec.	**Adria**	1,039	1880	Steel	Marseilles—Fiume	General	Beached Porthuan Bay, cargo on fire.
,,	**Abbazia**	2,913	1883	Iron	Savannah—Trieste	Cotton, &c.	Arrived cargo on fire afterhold—cotton damaged.
,,	**Dordogne**	3,806	1889	Steel	Haiphong—Marseilles	Cottonseed, oil, copra, &c.	Fire broke out at sea, cargo, forehold, badly damaged.
,,	**Orion**	668	1874	Iron	At Vardoe	.....	Destroyed by fire.
,,	**River Lagan**	803	1882	Iron	At Terneuze	Jute, wool, &c.	Took fire in port, 545 bales jute, 43 bales wool damaged.
,,	**J. Emery Owen**	1,739	1888	Wood	Manitowe Buffalo	Barley and oats	Ship and cargo badly damaged by fire, Lake Michigan.

FOREIGN SAILING VESSELS.

Jan.	**Malmen**	647	1892	Wood	Unkualofa—Europe	.....	Abandoned on fire.
March	**Amicitia**	1,153	1885	Iron	At La Roque from New York	Petroleum (nearly all discharged)	Destroyed by fire.
,,	**Tabitha**	930	1873	Wood	Pensacola—Buenos Ayres ...	Timber	Destroyed by fire.
April	**Nereide**	1,805	1890	Steel	At Cardiff for Pisagua	Patent fuel	Took fire in port, scuttled, extensive damage to ship and cargo.
Aug.	**Angela E. Maria** ...	664	1868	Iron	At New York for Cette	.....	Destroyed by fire.
,,	**Amsterdam**	1,139	1893	Steel	At New York loading for New Zealand	.....	Took fire in port, serious damage ship and cargo.
Dec.	**San Leonardo**	7898	1875	Wood	At Marseilles from Philadelphia	Benzine	Fire following explosion, vessel and cargo destroyed.

	British Steam.	British Sail.	Foreign Steam.	Foreign Sail	
Totals ...	46	9	46	7	Total (all Nationalities) 108.

January 18, 1904.

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OF THE

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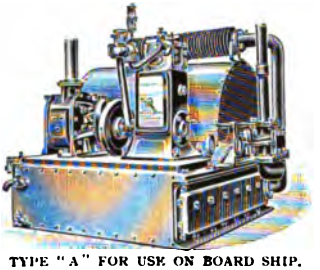

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OBJECTS OF THE COMMITTEE:

The main objects of the Committee are :—

To direct attention to the urgent need for increased protection of life and property from fire by the adoption of preventive measures.

To use its influence in every direction towards minimising the possibilities and dangers of fire.

To bring together those scientifically interested in the subject of Fire Prevention.

To arrange periodical meetings for the discussion of practical questions bearing on the same.

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CHARLES ADAMI, *Assistant Secretary.*

Fig. 7. VIEW TAKEN BEFORE TEST (OUTSIDE).

NOTE.

This report deals with a partition which was tested with the view of ascertaining whether it could be classified as affording "Partial Protection" (Class A) under the Committee's Universal Standards of Fire Resistance.

In order to be thus classified the following test must have been applied, namely: a fire test of 90 minutes' duration at a temperature gradually increasing to 1,800° Fahr., followed by the application of water for 2 minutes. The superficial area of the partition under investigation must be at least 80 sq. ft., and the total thickness of the partition must not exceed $2\frac{1}{2}$ in.

The Partition here reported upon was the first with which a maker attempted to ascertain whether this classification could be attained with a $2\frac{1}{2}$ in. partition.

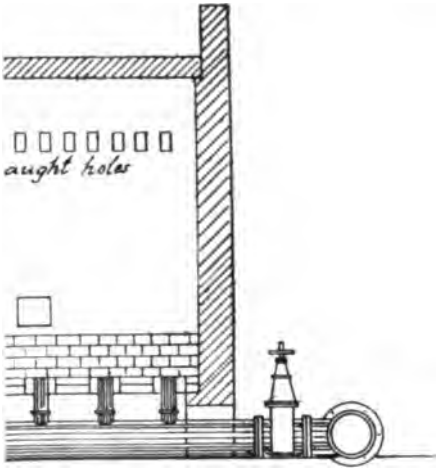
ELLIS MARSLAND.

LONDON,
September 26th, 1904.

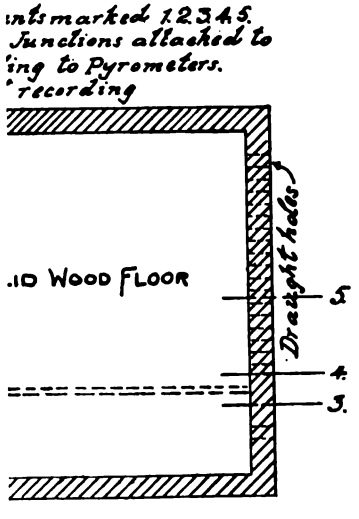
Note.—The issue of this Report was postponed for special reasons by order of the Executive. *16.12.08.*

Fig. 8. VIEW TAKEN AFTER TEST (OUTSIDE).

[Obj. p. 6



LOOKING NORTH



AN OF ROOF.

[Opp. p. 7.

OFFICIAL REPORTS

OF THE

British Fire Prevention Committee

[FOUNDED 1897—INCORPORATED 1899.]

FIRE TEST NO. 51.—JULY 28TH, 1904.

A PARTITION

FORMED WITH

BRUNCKHORST PARTITION SLABS,

AND ERECTED BY

H. GUST & CO.,

LONDON.

OBJECT OF TEST.

To record the effect of a fire of one hour and a half duration, at a temperature gradually increasing to about 1,800° Fahr. (*982·2° C.*), but not to exceed 2,100° Fahr. (*1148·8° C.*), followed by the application of water for two minutes on the fire side, on a partition not exceeding 2½ in. (*0·63 m.*) in thickness, with a view of being classified as affording "Partial Protection" (Class A).

Note.—The area of the partition under investigation was to be at least 75 ft. (*6·97 □ m.*) superficial, with a width of 10 ft. (*3·048 m.*).

Note.—The time allowed for the construction and drying of the partition was to be four weeks.

SUMMARY OF TEST.

No effects of the fire were apparent on the passage side of the partition during the fire test except small cracks following the joints which closed before the conclusion of the test.

The temperature on the passage side at no time exceeded 126° (*52·2 C.*).

Neither fire nor smoke passed through the partition.

On the fire side the plastering flaked in patches, and fell off.

On the application of water on the fire side the plastering was washed away where struck by the jet, and the surface of the partition was eroded, and a hole 6 in. by 3 in. (*0·15 m.* × *0·07 m.*) was made through one of the slabs.

DESCRIPTION OF TESTING PLANT.

(*See Figs.* 1 *to* 4.)

The Testing Chamber used was located at the Committee's Testing Station, and was known as "No. 1 Hut."

The hut was constructed, as shown, of stock bricks, with lime mortar, and measured 10 ft. by 10 ft. (*3·048* × *3·048 m.*) internally.

The ceiling was 8 ft. 10 in. (*2·705 m.*) above the pavement of the hut, and was constructed of wood beams.

The hut was covered in with a tarpaulin.

The door opening in the wall measured 2 ft. by 6 ft. 6 in. (*·61* × *1·981 m.*) and was open during the test.

The fuel used was gas produced at the station, and the supply was regulated by valves and dampers.

The hut was divided as shown on plan, the partition being constructed from north to south, the full width and height of the hut, leaving the passage on the outside 2 ft. 7½ in. (*·799 m.*) wide.

The gas was admitted through two mixing chambers of fire-brick, each 7 ft. 2½ in. by 3 ft. 6 in. (*2·197 × 1·066 m.*) as shown.

Two Roberts-Austen pyrometers were used for recording temperatures, one taking a continuous record from point No. 5, and one being used for the observation records at points Nos. 1, 2, 3, 4. Points Nos. 1, 4, 5 were

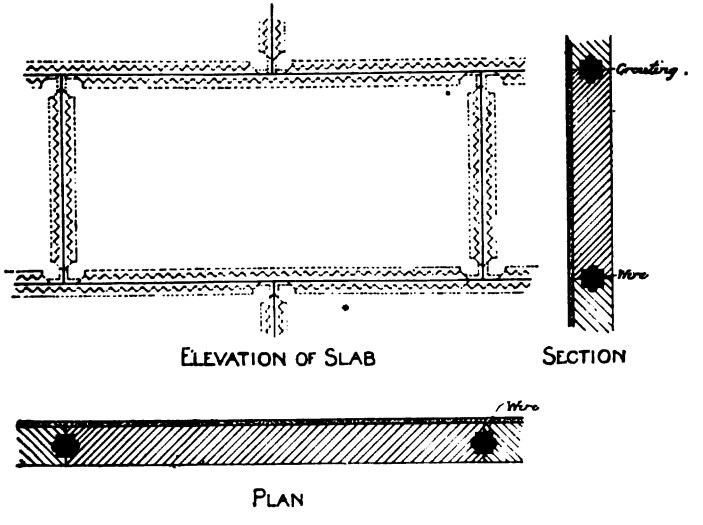


Fig. 5. THE PARTITION SLABS.

inside the chamber, and Nos. 2 and 3 outside in the passage.

There were two observation holes, one in the north and one in the south walls, and two small observation holes in the east wall.

The stream of water was applied to the inside face of partition, through the observation hole on the south side, by a branch with ¾ in. (*·019 m.*) nozzle, and supplied from a small steam fire engine.

CONSTRUCTION OF THE PARTITION.

(See Figs Nos. 1 to 5.)

Plans, elevations, and sections of the partition are shown.

The construction of the partition was as follows :—

On June 29th and 30th the partition was erected. The slabs forming the partition were built on a course of bricks laid on the floor of the hut, and were carried up to the under side of the ceiling beams to a height of 8 ft. 6 in. (*2·590 m.*) The partition was composed of slabs each 12 in. (*·304 m.*) in height and 2¼ in. thick (*·057 m.*) and of lengths varying from 10 in. to 2 ft. (*·254 m.* to *·609 m.*). The joints, both horizontal and vertical, were grooved and serrated. (See detail, Fig 5.)

In the centre of the vertical and horizontal joints of the partition iron wires $\frac{1}{16}$ in. diameter were placed, the horizontal ones secured to hooks in the walls of the hut, and the vertical ones twisted over the horizontal ones in double thickness.

On the passage side the partition was finished against the end walls with a strip of plaster 2½ in. by 1½ in. (*·063 m.* × *·038 m.*).

On the fire side the partition was finished against the end walls by a strip of plaster 3 in. by ½ in. (*·076 m.* × *·012 m.*) to within 10 in. (*·254 m.*) of the ceiling line.

Above this up to the ceiling there were slabs of the same thickness as those in the partition. These were continued round the joint next the ceiling, and were about 6 in. (*·152 m.*) wide.

The partition was plastered on the fire side with plaster of Paris and coke dust, 1 to 1. Average ¼ in. (*·006 m.*) thick.

The slabs forming the partition were jointed with the same material run into the serrated groves around the edges of the slabs.

A wash of the plaster material was applied to the face of the slabs on the passage side.

The slabs were described by the maker as being composed of plaster of Paris and coke breeze 1 to 1.

The weight was 80 lbs. (*36·29 k.*) per sq. yard (*·836 □ m.*).

A coke fire was lighted on July 25th, and kept burning in the hut during each day until July 28th, when it was removed.

THE TEST.

On July 28th, 1904, the test was undertaken. The following is a log of the test:—

At 3 p.m. the meteorological observations taken at the Botanical Gardens, Regent's Park, read as follows:—

"State of weather, cloudy; Wind, S.W.; Barometer, 30·02 in. (*·762 m.*); attached thermometer, 68° Fahr. (*20·0 C.*) Wet Bulb, 63° Fahr. (*17·20 C.*); Dry Bulb, 68·5° Fahr. (*20·2 C.*) Remarks: Fine warm afternoon."

At 2 p.m. the gas was lighted.

	Observations on the Outside.	Minutes Elapsed.
2.3 p.m.	Joint 5 opening and a vertical hair crack from this joint upwards about 4 ft. 6 in. from N. side.	3
2.5 p.m.	Vertical hair crack 2 feet from S. side from joint 4 upwards.	5
2.6 p.m.	Several vertical and horizontal cracks in partition.	6
2.10 p.m.	Steam coming through some of the joints and cracks, showing a stain on the white surface.	10
2.25 p.m.	Joints and cracks between slabs all closing up, and the moisture drying out.	25
3.30 p.m.	The fire had not passed through the partition, and the surface on the passage side, except for the cracks before mentioned, was unaffected by the fire.	90

A thermometer was hung on the outside face of the partition during the test, and the following is the record :—

		Minutes Elapsed
2.12 p.m.	80° (*26·6 C.*)	12
2.15 „	96° (*35·5 C.*)	15
2.20 „	110° (*43·3 C.*)	20
2.30 „	115° (*46·1 C.*)	30
2.47 „	112° (*44·4 C.*)	47
2.52 „	115° (*46·1 C.*)	52
3.2 „	118° (*47·7 C.*)	62
3.20 „	120° (*48·8 C.*)	80
3.25 „	123° (*50·5 C.*)	85
3.30 „	126° (*52·2 C.*)	90

OBSERVATIONS ON THE INSIDE.

		Minutes Elapsed
2.17 p.m.	Horizontal cracks in plastering at joints appeared in two places.	17
2.20 p.m.	Additional crack in plastering at joint near bottom of partition.	20
2.33 p.m.	Two vertical cracks in plastering appeared near bottom of partition.	33
2.40 p.m.	One horizontal crack in plastering appeared near top of partition, and a vertical one near same.	
2.45 p.m.	The plastering on face showing tendency to flake at joint above the centre of partition.	45
3.0 p.m.	Plastering cracking badly.	60
3.10 p.m.	Patch of plastering, 4 ft. by 3 ft. (*1·219 m.* × *·914 m.*) fallen at north corner.	70
3.15 p.m.	Plastering flaking on South side.	75
3.22 p.m.	Plastering flaking generally.	82
3.27 p.m.	Plastering all fallen on North side, but some still remaining on South side.	87
3.30 p.m.	The gas was turned off.	90

Minutes Elapsed.

3.33 p.m. Water was turned on to the inside face of the partition for two minutes at 40 lbs. pressure (*18·14 kg.*) per square inch (*0·25 □ m.*) 93

The effect of this was to wash off some of the surface of the slabs where struck by the water, and a hole 6 in. by 3 in. (*1·82 × ·09 m.*) was made through the partition at the fifth joint 3 ft. 6 in. (*1·07 m.*) from the South end. On the outside face the water had leaked through some of the joints.

The temperatures, as read from the observation record off pyrometer points Nos. 1, 2, 3, and 4 were as follows:—

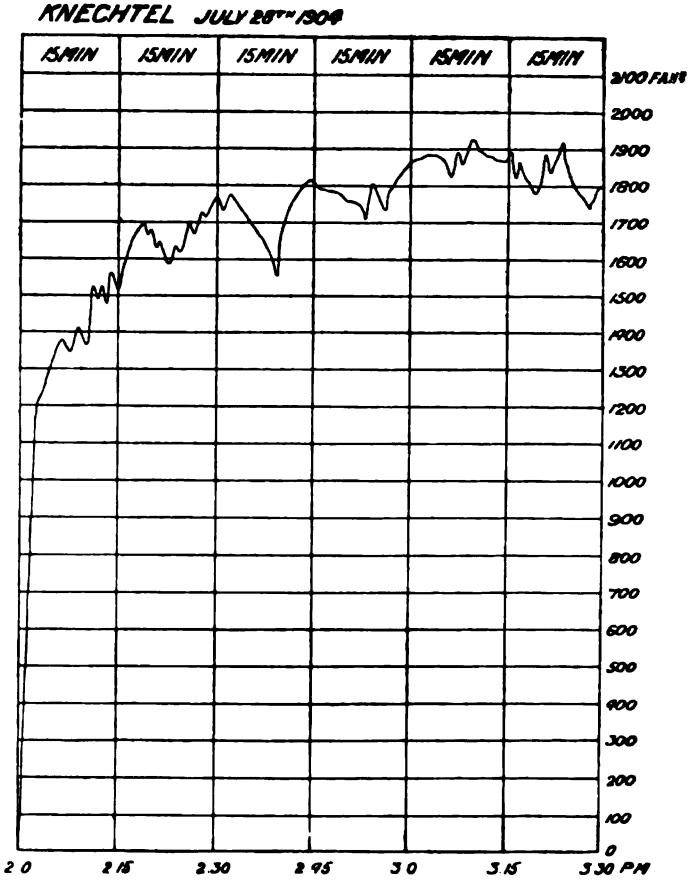
OBSERVATIONS TAKEN FROM POINTS NOS. 1, 2, 3, 4.

From 2.0 *p.m. to* 3.30 *p.m.*

Time.	Inside.		Outside (in passage).		Minutes Elapsed.
	No. 1.	No. 4.	No. 2.	No. 3.	
	Deg. Fahr.	Deg. Fahr.	Deg. Fahr.	Deg. Fahr.	
2.0 p.m.	Fires lighted				
2.5 „	1180	1245	—	—	5
2.10 „	1265	1330	—	—	10
2.15 „	1330	1355	—	—	15
	(*721·1*)	(*735·*)			
2.20 „	1445	1460	—	—	20
2.25 „	1435	1440	—	—	25
2.30 „	1510	1555	—	—	30
	(*821·1*)	(*846·1*)			
2.35 „	1540	1520	—	—	35
2.40 „	1430	1420	—	—	40
2.45 „	1585	1610	—	—	45
	(*862·7*)	(*876·6*)			
2.50 „	1600	1615	—	—	50
2.55 „	1580	1585	—	—	55
3.0 „	1630	1630	—	—	60
	(*887·7*)	(*887·7*)			
3.5 „	1680	1650	—	—	65
3.10 „	1655	1680	—	—	70
3.15 „	1710	1700	100	100	75
	(*932·2*)	(*926·6*)	(*37·7*)	(*37·7*)	
3.20 „	1720	1645	120	120	80
3.25 „	1760	1680	110	110	85
3.30 „	1800	1680	120	120	90
	(*982·2*)	(*915·5*)	(*48·8*)	(*51·6*)	

Degrees in italics are in Centigrade.

The following is the record taken from the continuous record at Point No. 5 :—



OBSERVATIONS AFTER TEST.

(*Figs.* 7, 8 *and* 9.)

On Aug. 4th, the following observations were made :— The face of the partition on the passage side had undergone no change since the conclusion of the test.

The thickness of the partition around the hole eroded by the jet was ½ an inch (·012 *m.*), and the wiring was exposed in places.

The exposed surfaces of the slabs, where not eroded by the water, were intact.

GENERAL ARRANGEMENTS.

The Test was carried out according to the procedure laid down by the Executive for investigations of this description, and conducted by a Sub-Committee of the Executive, comprising :—

Mr. Ellis Marsland, Distr. Surveyor, (Directing Member).
Mr. J. Herbert Dyer (Vice-Pres. N.F.B.U.)

Mr. A. H. Lister assisted the Sub-Committee.
Mr. H. B. White, M.Inst.E.E.. superintended in the Instrument Room.

The Council was represented by :—
Major-General E. R. Festing, C.B., F.R.S.

The Executive was represented by :—
Mr. Edwin O. Sachs, F.R.S. Ed. (Chairman).
Mr. Percy Collins, J.P.
Mr. L. J. Langridge, A.M.I.E.E. (*since deceased*).
Mr. J. W. Restler, M.Inst.C.E.
Mr. James Sheppard, A.Inst.E.E. (*since deceased*).

The General Body of Members was represented by :—
Wm. Grellier, F.R.I.B.A. (District Surveyor, Clapham); Geo. McDonell (District Surveyor, Islington); E. J. A. Fulkes ; Frank Sumner, M.Inst.C.E.

Messrs. H. Gust & Co. were represented by :—
Mr. H. Knechtel.

The following visitors attended by special invitation of the Executive :—

Mr. John P. Bishop (Carlton Hotel); Mr. H. G. Cooke; Mr. J. C. Day; Mr. N. Elliott (Architects' Dept., L.C.C.); Lieut.-Col. Fox, F.R.G.S. (London Salvage Corps); Mr. E. W. F. Grellier, Junr.; Mr. Thomas Hoad; Mr. Robert Ray; Mr. Geo. Ridout; Mr. J. Schnuetgen; Mr. J. Stransom's Deputy (Theatres Branch, L.C.C.); Mr. W. Tidman.

Signed,

For the Sub-Committee conducting the Test and for the General Testing Arrangements Sub-Committee :—

ELLIS MARSLAND (*Directing Member*).

For the Executive :

EDWIN O. SACHS (*Chairman.*).

September 26th, 1904.

Publication postponed as directed by the Executive in 1904, and issued as ordered by the Executive, December 16th, 1908.

CHAS. ADAMI
(*Assist. Secretary*).

Date—December 16th, 1908.

Verified a true copy of the Report, ordered to be published.

ROSE INNES, SON AND CRICK (*Solicitors*).

Date—December 29th, 1908.

blications of the

BRITISH FIRE PREVENTION COMMITTEE—No. 87.

ited by the Executive.

FIRE TESTS
WITH
AUTOMATIC SPRINKLERS.

AUTOMATIC SPRINKLERS

SUBMITTED FOR TEST BY

THE ALBION SPRINKLER COMPANY, LIMITED,

LONDON.

The Report of the Committee

ALL RIGHTS RESERVED.

LONDON, 1904.

PUBLISHED AT THE OFFICES OF
THE BRITISH FIRE PREVENTION COMMITTEE
(Founded 1897—Incorporated 1899),
1, WATERLOO PLACE, PALL MALL.

Two Shillings and Sixpence.

OBJECTS OF THE COMMITTEE:

The main objects of the Committee are :—

To direct attention to the urgent need for increased protection of life and property from fire by the adoption of preventive measures.

To use its influence in every direction towards minimising the possibilities and dangers of fire.

To bring together those scientifically interested in the subject of Fire Prevention.

To arrange periodical meetings for the discussion of practical questions bearing on the same.

To establish a reading-room, library and collections for purposes of research, and for supplying recent and authentic information on the subject of Fire Prevention.

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J. W. RESTLER, M.Inst.C.E., late Chief Eng., Southwark and Vauxhall Waterworks ;
E. de SEGUNDO, A.M.Inst.C.E., A.M.I.Mech.E.

Gen. Hon. Secretary :

ELLIS MARSLAND, District Surveyor.

Hon. Auditors :

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HORACE S. FOLKER, F.A.I., Gen. Hon. Sec. Nat. Fire Brigades' Union.

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Regent Street, W.

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WESTBOURNE LODGE, BAYSWATER, W.

Offices :

1, WATERLOO PLACE, PALL MALL, LONDON, S.W.
(CHARLES ADAMI, *Assistant Secretary.*)

THE GENERAL ARRANGEMENTS FOR TESTS.

(*MEMORANDUM.*)

THE purpose of the tests undertaken by the British Fire Prevention Committee is to obtain reliable data as to the exact fire-resistance of the various materials, systems of construction, or appliances used in building practice for the detection and extinction of fire.

The tests are of an entirely independent character, arranged on scientific lines, but with full consideration for the practical purpose in view. Absolute reliability is assured, records being mostly taken automatically, or by photography, and the temperatures being easily regulated by the application of gas.

All reports on tests solely state the bare facts and occurrences, with tables, diagrams, and illustrations, and on no account are reports to be taken as including expressions of opinion, nor should any expression be read as a comparison or criticism.

The general arrangement and direction of the tests are in the hands of the Executive, who act in accordance with certain principles laid down after careful study and experiment. The official tests are attended by the members of the Council and the members of the Committee in rotation.

As to the Committee's present Testing Station, it comprises a house, standing in its own grounds, near Royal Oak Station, and backing on to the Great Western Railway. The principal building is used for Committee Rooms and laboratory purposes, whilst the gardens are utilised for so-called "full-size" tests.

As to the financial aspect of the station, the establishment expenses are being met by a special subscription. As far as the funds of the committee permit, investigations and experimental tests with ordinary (*i.e.*, not patented) forms of construction are undertaken from time to time and duly reported on. Official tests with patented materials, makers' systems, etc., etc., are subject to a scale of charges, but these charges are so figured as to only just cover the actual cost. The Testing Station is also open to members for such private research work or tests they may desire to undertake.

The services of the members participating in the management of the station, conducting or attending tests, are given entirely gratuitously.

For the Executive,

EDWIN O. SACHS, *Chairman.*

NOTE.

Automatic sprinkler heads, when submitted to the Fire Offices' Committee for approval, are tested to ascertain if they comply with standard requirements.

The Albion Sprinkler has successfully passed such ordeal.

Technical observations made during the course of tests for the Fire Offices are not made public, and the Report now issued by the British Fire Prevention Committee is believed to be the first technical record published in this country of an independent test of automatic sprinkler heads.

This Report brings out some interesting facts not hitherto generally available, more particularly with regard to the sensitiveness of sprinkler heads under conditions to which they are subject in actual practice.

The temperature needed to melt the special solder (alloy) used to hold together the struts or levers retaining the valve seal in position has been shown to be considerably higher than is usually assumed to be the case, the cause for this being that heat is conducted away by the iron pipes—whether charged with water or not—to which the sprinkler heads are attached. This action is somewhat increased when the supply pipes are below the sprinkler heads which is the case with inverted sprinklers.

As the success of automatic sprinkler heads primarily depends upon the actual melting point of the solder (alloy) in the sprinklers when fixed as in ordinary practice, the facts recorded will be seen to be of considerable importance, and may account for some of the instances

where sprinklers have not done the duty expected of them, especially in connection with smouldering fires.

To avoid the facts presented in this Report regarding the special type of sprinkler under consideration being misunderstood by reason of the temperatures at which the sprinklers operated being higher than those generally associated with efficient sprinklers, the Committee considered it essential that some experimental tests should be made with other approved types of sprinkler heads and such tests were made for sensitiveness with sprinklers in a pendent position.

The result was that the average temperature at which five different types of known sprinklers came into action when connected with uncharged pipes was 191° Fahr. (ranging from 177° to 202° Fahr.), and with wet pipes 193° Fahr. (ranging from 188° to 198° Fahr.), showing an average over all tests of about 192° Fahr. These other types of sprinklers have not yet been subjected by the Committee to tests with sprinklers heads inverted, involving fuller exposure of the iron piping.

JAMES SHEPPARD.

LONDON,
November 2, 1904.

OFFICIAL REPORTS

OF THE

British Fire Prevention Committee

[FOUNDED 1897—INCORPORATED 1899.]

FIRE TESTS No. 54. JULY 28TH, 1904.

AUTOMATIC SPRINKLERS

SUBMITTED FOR TEST BY

THE ALBION SPRINKLER COMPANY, LTD.,
LONDON.

OBJECT OF TEST.

To record the action of the Albion Automatic Sprinkler Head, under conditions similar to those existing during actual fires, and also as to its stability under variations of pressure.

Notes as to Tests applied.

1. Sprinkler heads subjected to a test with regard to sensitiveness and the falling away of struts, levers, and valve seats, on opening.

   First with Sprinkler head dry.

   Secondly with Sprinkler head charged with water at the temperature of the air under a pressure of 12 lbs. per square inch (*0·8 atmospheres*).

2. Sprinkler heads subject to a fire test in a chamber 20 ft. × 10 ft. × 9 ft. 6 in. (*6·1 × 3·05 × 2·9 m.*) high

from floor to under side of joists, with sprinklers charged with water under a pressure of 10 lbs. per square inch (*0·66 atms.*) to ascertain—

First, the time and temperature required to open.
Secondly, Distribution of water;

Each test applied to a sprinkler head placed pendent under, and to a sprinkler head inverted over the respective supply pipes.

3. Sprinkler head subject to a test to show its power to resist leakage or injury under sudden variation of water pressure up to 500 lbs. per square inch (*33·33 atms.*).

SUMMARY OF RESULTS.

No. 1. *Sensitiveness.*

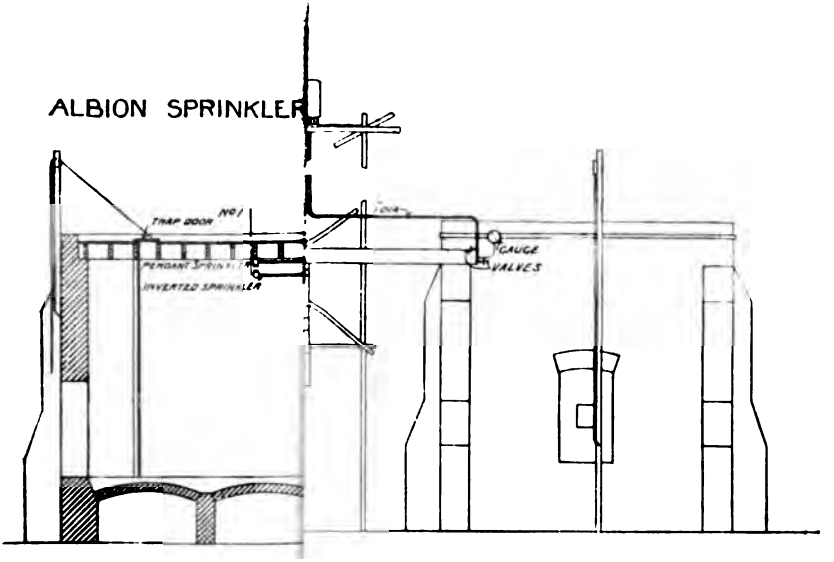
With heads *inverted* and subjected to a gradual rise of temperature the sprinkler opened at a temperature of 204° F. (*95·5° C.*) when wet, and at 208° F. (*97·7° C.*) when dry, an average of 201° F. (*93·8° C.*). With sprinkler heads *pendent* the average temperature at which they opened was 181° F. (*82·7° C.*) dry, and 190° F. (*87·7° C.*) wet, the average of both dry and wet being 185° F. (*85° C.*).

No. 2. *Sensitiveness and Water-distribution.*

With sprinklers subjected to a quick fire heat and charged at a pressure of 10 lbs. (*0·66 atms.*), they opened when *inverted* at an average temperature of 209° F. (*98·3° C.*) in 240 seconds, and when *pendent* at an average temperature of 219° F. (*103·8° C.*) in 180 seconds.

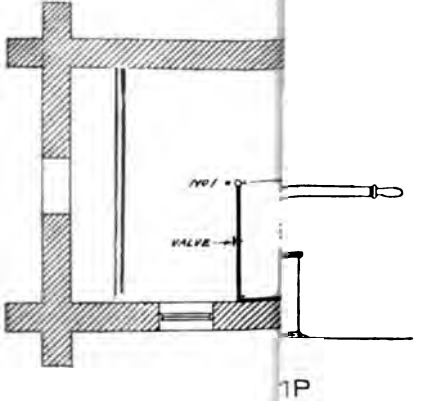
Note.—This test with *pendent* sprinklers was influenced by warmth remaining in walls and pipes after the test with *inverted* sprinklers.

In each case on the opening of a sprinkler the parts fell clear away leaving the discharge free.



LONGITUDINAL ELEVATION

FIG 3



1P

× *Position of the*

PRESSURE PUMP.

The water distribution under the minimum pressure of 10 lbs. per sq. in. (*0·66 atms.*) is recorded on pages 22 and 23.

Note.—The water distribution was unfavourably influenced by the nearness of the sprinkler heads to the underside of the joists.

No. 3. *Stability.*

The sprinkler heads sustained varying pressures up to 500 lbs. per sq. in. (*33·3 atms.*) without leaking or change that could be discovered.

DESCRIPTION OF THE SPRINKLER.

The following is the Makers' description of the Sprinkler:

The Body (**B**), Valve (**V**), Toggle Levers (**T L**), Dash Plate (**D P**), Pin (**P**), and Screw (**S**), are made of Gun Metal. The Link (**L**) is made of Gun Metal or Copper Nickel.

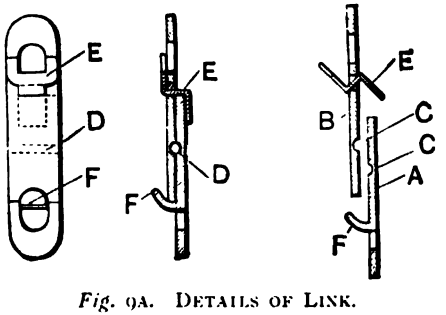


Fig. 9A. DETAILS OF LINK.

The Albion Sprinkler is a Link Sprinkler, and constructed on the Cantilever Principle. Referring to Fig. 9, the Valve is kept in place by means of the two Toggle Levers (**T L**), the lower being kept in place by the Screw

(**S**). The water-pressure tends to force the Toggle Levers apart and so release the Valve, but the Levers are held in position by the Link (**L**). Referring to Fig. 9A, the Link consists of two pieces of Copper Nickel (**A** and **B**) with two grooves cut for the insertion of the Pin (**D**) and a thin sheet of bent brass (**E**) to hold the various parts together. The sensitive solder is placed

B = Body of Sprinkler.
TL = Toggle Lever.
L = Link.
V = Valve.
DP = Dash Plate.
P = Pin.
S = Screw.

Full size.

Fig. 8. Details of Sprinkler Head Open as in Operation.

between the two pieces of Copper Nickel—the Brass Sheet and under the nose (**F**) making a rigid but sensitive series of joints—when the Solder melts these joints give way and all the parts are intended to fall clear away, allowing the water free access on to the Deflector or Dash Plate (**D P**) (see Fig. 8).

DESCRIPTION OF TESTING PLANT.

(*See Figs.* 1 *to* 10).

1. *For the Test for Sensitiveness :*

A conservatory building abutting on the Committee rooms of the Testing Station was allotted for the test for sensitiveness.

The conservatory is of glass in wood framing.

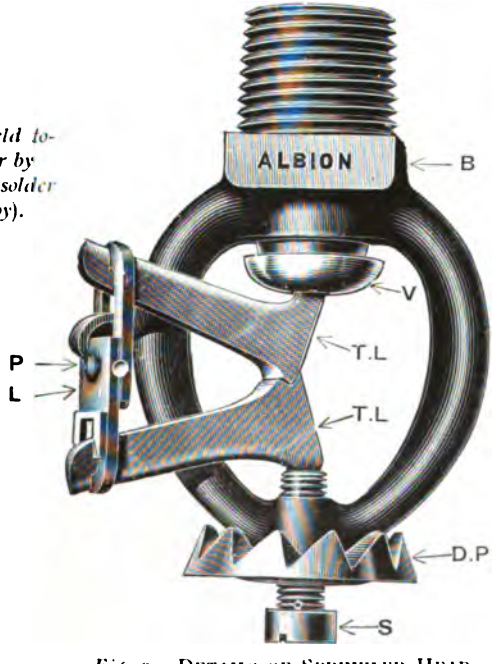


Fig. 9. DETAILS OF SPRINKLER HEAD.

2. *For the Fire Test :*

A testing chamber, located at the Committee's Testing Station, known as "No. 2 Hut," was allotted for the fire test.

The chamber constructed, as shown (Figs. 1, 2, and 3), of stock bricks, with lime mortar, measured by 22 ft. 3 in. ×

10 ft. (*6·78 × 3·05 m.*) internally, reduced by wood partition to 20 ft. × 10 ft. (*6·1 × 3·05 m.*).

The soffits of the joists of the ceiling over this chamber were 9 ft. 6 in. (*2·9 m.*) above the floor of the chamber.

The door openings on the north, south, and west sides measured 2 ft. by 6 ft. (*·61 × 1·828 m.*), and were closed by being filled in with brickwork, 4½ in. (*·114 m.*) thick.

There were four observation holes in the east wall, one in the south wall, one in the north wall, and two in the west wall, the last four being formed in the bricked-up door openings, and each covered with a movable iron shutter.

The draught holes were in the east, north, and south walls.

3. *For Stability Test under Variations of Pressure.*

Hydraulic pump with a Crosby pressure gauge as shown by Fig. 4, was used.

The photographs were taken by daylight.

ARRANGEMENTS FOR THE TESTS.

(*See Figs. 1 to 7.*)

1. *The Test for Sensitiveness,* and falling away of the parts of sprinkler head on opening, was made in a glazed box having wood frame with wood floor and top measuring over all 3 ft. 3 in. by 3 ft. 2 in. by 3 ft. ½ in. high (*0·99 × 0·96 × 0·92 m.*), supported on brick piers in the conservatory at the Committee's Testing Station.

A ¾ in. (*0·19 m.*) iron pipe with bend and elbow was passed through the wood cover of box, into which sprinkler heads were screwed in an inverted position above the bend and elbow before referred to, as shown in Fig. 5.

An atmospheric portable gas stove was placed on the

floor of the box having metal plate immediately over to distribute the heat. This plate was removed during the latter part of the first test, and was not used for the second test.

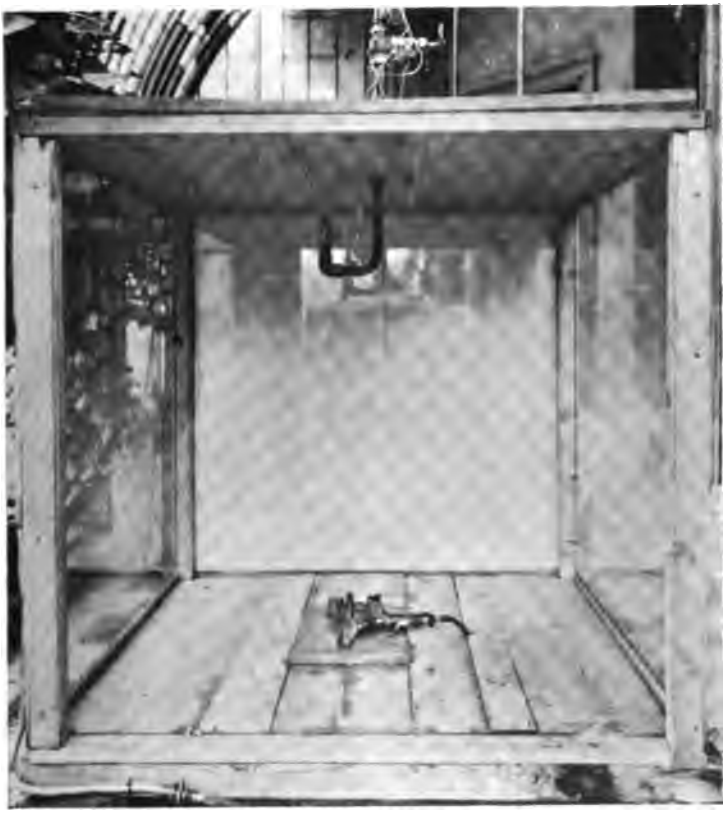


Fig. 5. THE GLASS BOX FOR TESTS AS TO SENSITIVENESS.

A glass tube thermometer was suspended through a hole in the top of the box close to the sprinkler head. The correctness of the thermometer was verified by reference to a standard thermometer.

Fig. 6. VIEW OF TESTING CHAMBER, SHOWING PIPES AND OPEN JOISTS OF CEILING.

Fig. 7. VIEW OF TESTING CHAMBER, SHOWING PIPES AND OPEN JOISTS OF CEILING.

2. *The Fire Test* was made in Testing Chamber located at the Committee's Testing Station known as "No. 2 Hut," across which a boarded partition was fixed, making the chamber 20 ft. by 10 ft. (*6·1 × 3·05 m.*), the ceiling constructed with 9 in. by 2½ in. (*0·23 × 0·064 m.*) open joists extending across the chamber spaced to 15 in. (*0·38 m.*) centres, covered on top with 1 in. (*0·025 m.*) tongued boarding. Trap doors were formed at either end in the ceiling to allow of the escape of warm air between the tests.

Two 1 in. (*0·025 m.*) pipes connected with single 1 in. (*0·025 m.*) pipe from the elevated tank were carried along one of the side walls inside the chamber; from each of these 1 in. (*0·025 m.*) pipes two ¾ in. (*0·019 m.*) pipes passed to the centre of the space between the side walls of the chamber, 5 ft. (*1·524 m.*) from either end. Sprinkler heads to be tested were screwed into the ends of each of the ¾ in. (*0·019 m.*) pipes referred to, one head in each case being placed in an inverted and one in a pendent position. All pipes were of iron.

This arrangement provided for the sprinklers being 10 ft. (*3·048 m.*) apart and 5 ft. (*1·524 m.*) from walls in every direction as shown on Figs. 1 and 2.

Stop-cocks were inserted in the pipes, so that water could be turned on to any one or all of the sprinklers.

Fire heat was provided by burning methylated spirit in two metal trays 1 ft. 3½ in. by 1 ft. and 2¼ in. deep (*0·394 × 0·305 × ·057 m.* deep) placed on the floor of hut under the centre line of the space between the sprinklers as indicated on Figs. 1 and 2. Each tray was charged with about half a gallon of methylated spirit (*2·27 lit.*).

Two Roberts-Austen pyrometers were used for recording the temperatures, one placed close to each group of sprinkler heads, and known as Points No. 1 and No. 2 shown on Fig. 1.

Water was supplied to the sprinklers by ¾ in. (*0·019 m.*) pipes, connected with a 1 in. (*0·025 m.*) iron pipe before

described, from a tank 5 ft. by 3 ft. and 7. ft. deep (*1·524 × 0·914 × 2·134 m.*) supported on a stage near the chamber ; the bottom of tank was 21 ft. 1 in. (*6·426 m.*) above the connection for the higher and 21 ft. 7 in. (*6·578 m.*) above the connection for the lower sprinkler head. The depth of water in the tank was 1 ft. 8½ in. (*0·52 m.*), giving with the thickness of the bottom of tank 22 ft. 10 in. (*6·96 m.*) head of water to the higher and 23 ft. 4 in. (*7·11 m.*) to the lower sprinkler.

Each sprinkler, therefore, had a static pressure of, say, 10 lbs. per square inch (*0·66 atms.*), this was verified by a pressure gauge fixed to the 1 in. (*0·025 m.*) supply pipe at the level of the higher sprinkler which registered a static pressure of slightly over 10 lbs. (*0·66 atms.*).

Water Distribution Test.—Pans were placed on the floor of the chamber arranged as shown on Figs. 11 and 12 (pages 22 and 23) to retain water distributed by the sprinklers. The walls, ceiling, and joists of the chamber were lime-washed a blue tint.

3. For the stability test a hydraulic pump was used with gauge registering pressures up to 500 lbs. per square inch (*33·33 atmospheres*).

THE TESTS.

On July 28, 1904, the tests were undertaken.

Note.—The sprinkler heads used had links of gun metal.

The following being a log of the test for :—

1. Sensitiveness and Falling Away of Parts.

Sprinkler dry.

Gas stove lit at 2h. 59m. 45s. o'clock p.m. in the glazed box before described, the temperature in the box then

being 74° Fahrenheit. Reading of thermometer commenced at 3 p.m.

Observations taken during the Test.

Minutes Elapsed.	Temp. Fahr.		Minutes Elapsed.	Temp. Fahr.	
0	80°	(26·6° C.)	19	145°	
1	92°		20	145°	(62·7° C.)
2	98°		21	147°	
3	106°		22	148°	
4	114°		23	149°	
5	117°	(47·2° C.)	24	150°	
			25	151°	(66·1° C.)
6	120°		26	152°	
7	123°		27	153°	Temperature on floor of box 104° (40° C.).
8	126°		28	154°	
9	128°		29	154°	
10	130°	Temperature on floor of box 86° (30° C.).	30	155°	(68·3° C.)
11	133°	(56·1° C.)	31	155°	
12	135°		32	156°	Heat distributing plate over gas stove removed.
13	137°		33	166°	Gas jets 2 ft. 3 in. from sprinkler.
14	138°		34	194°	
15	140°	(60·0° C.) Temperature on floor of box 92° (33·3° C.).	35	202°	(94·4° C.) Signs of solder softening at 204° (95·5° C.).
16	140°		36	205°	
17	142°		36½	208°	(97·7° C.) Sprinkler opened in 36½ minutes.
18	143°				

On the opening of the sprinkler all parts fell clean away leaving the outlet free.

Sprinkler charged with water having a head of 29 ft., giving a pressure of 12·5 per sq. in. (0·83 atms.).

Gas lit at 4h. 55m. 45s. p.m. No distributing plate over gas stoves. Temperature of box 76°. Reading of thermometer commenced at 4·56 p.m.

Observations taken during the Test.

Minutes Elapsed.	Temp. Fahr.		Minutes Elapsed.	Temp. Fahr.	
0	84°		19	190°	(87·7 C.) Temperature on floor of box 86° (30° C.).
1	93°		20	190°	
2	140°		21	192°	
3	150°		22	192°	
4	158°	(70·0 C.)	23	192°	
5	165°		24	196°	(91·1 C.)
6	170°		25	197°	
7	172°		26	199°	
8	176°		27	199°	
9	178°	(81·1 C.)	28	200°	
10	179°		29	200°	(93·3 C.)
11	180°		30	201°	
12	180°		31	201°	
13	184°		32	203°	
14	186°	(85·5 C.)	33	204°	
15	187°		34	204°	(95·5 C.)
16	188°		35	204°	
17	189°		36	204°	(95·5 C.)
18	189°		—	——	Sprinkler opened in 36 minutes.

On the opening of the sprinkler the box was charged with streams of water. On this being turned off all the

sprinkler parts and valve seating were found on the floor of box and the outlet of the sprinkler head was clear.

2. Sensitiveness and Distribution Test.

In Hut No. 2.

1. *Sensitiveness Test.*—With two sprinkler heads INVERTED.

Methylated spirit in the two pans was set on fire by applying a match at 5.43 p.m. Flame from the burning spirit rising to a maximum of about 2 feet.

Both sprinklers opened at 5.47 p.m. practically simultaneously.

Pyrometer No. 1 registered 222° Fahr. (*105·5° C.*)

Pyrometer No. 2 registered 197° Fahr. (*91·6° C.*)

See log of pyrometer readings.—Fire test No. 1, page 24.

Chamber was cooled down between Fire Test 1 and 2.

2. Tests with two sprinkler heads PENDENT. Spirit was set on fire at 6.20 p.m., the sprinklers opened at 6.23 and 6h. 23m. 30s.

Note.—The pyrometer points had been disconnected in fixing the sprinkler heads and the pyrometers failed to register. These were put right and the test with pendent sprinklers repeated.

Spirit set on fire at 6.45 p.m., both sprinklers opened together at 6.48 p.m.

Pyrometer No. 1 registered 210° Fahr. (*98·8° C.*)

Pyrometer No. 2 registered 228° Fahr. (*108·8° C.*)

See log of pyrometer readings.—Fire test No. 2, p. 25.

Water Distribution Test.—No. 1. The sprinkler head PENDENT, the Deflector (Dash Plate) being 4 inches below bottom of joists.

The pans as described were placed on floor, the pan No. 1 being immediately below the sprinkler head.

Water was turned on at 7.5 p.m. and shut off at 7.8 p.m. The static pressure of water was 10 lbs. per sq. in.

Fig. 10. VIEW OF WATER TANK.

(*0·66 atms.*), and the running pressure 8 lbs. (*0·53 atms.*) as registered by pressure gauge.

The depth of water in the different pans, measured immediately after the turning off the supply, was found to be as follows :—

Pan No. 1	...	1¾ inch (·044 *m.*)	Pan No. 8	...	½ inch (·003 *m.*)
„ „ 2	...	1 „ (·025 „)	„ „ 9	...	½ „ (·013 „)
„ „ 3	...	½ „ (·013 „)	„ „ 10	...	¼ „ (·006 „)
„ „ 4	...	¼ „ (·006 „)	„ „ 11 to 14		¼ each (·006 „)
„ „ 5	...	¼ „ (·006 „)	„ „ 15	...	½ „ (·013 „)
„ „ 6	...	1¼ „ (·032 „)	„ „ 16	...	1 „ (·025 „)
„ „ 7	...	¼ „ (·006 „)			

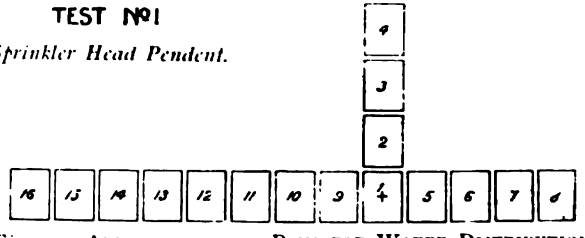


Fig. 11. ARRANGEMENT OF PANS FOR WATER DISTRIBUTION TEST No. 1.

Wall at end adjoining pan No. 8, test No. 1, was wet for its whole height.

The upper part of each side wall for about 2 feet below the joist was dry. The ceiling was wet between two only of the divisions between joists nearest sprinkler head. Two other of the joists on each side were wet and one slightly wet.

Water Distribution Test.—No. 2. One sprinkler head INVERTED ; Deflector (Dash Plate) of sprinkler 4 inches below the bottom of joist.

Water turned on at 7.27, shut off at 7.30 p.m.

Static pressure 9 lbs. (*0·6 atms.*), running pressure 6½ lbs. per sq. in. (*4·3 atms.*), as registered by pressure gauge.

The depth of water in the different pans measured immediately after the shutting off of supply was found to be as follows :—

Pan No.	1	...	1	inch	(0·25 *m.*)	Pan No.	9	...	1	inch	(0·38 *m.*)
,, ,,	2	...	1¼	,,	(0·20 ,,)	,, ,,	10	...	½	,,	(0·19 ,,)
,, ,,	3	...	½	,,	(0·13 ,,)	,, ,,	11	...	⅜	,,	(0·10 ,,)
,, ,,	4	...	½	,,	(0·13 ,,)	,, ,,	12	...	¼	,,	(0·06 ,,)
,, ,,	5	...	1½	,,	(0·38 ,,)	,, ,,	13	...	⅜	,,	(0·10 ,,)
,, ,,	6	...	1¼	,,	(0·32 ,,)	,, ,,	14	...	½	,,	(0·13 ,,)
,, ,,	7	...	⅜	,,	(0·22 ,,)	,, ,,	15	...	⅜	,,	(0·10 ,,)
,, ,,	8	...	1⅜	,,	(0·35 ,,)	,, ,,	16	...	¼	,,	(0·06 ,,)

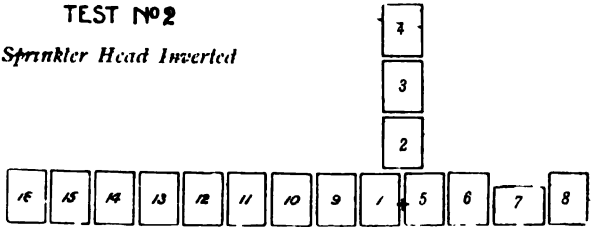


Fig. 12. ARRANGEMENT OF PANS FOR WATER DISTRIBUTION TEST NO. 2.

The distribution on ceiling and walls was somewhat less than that described above.

Note.—The distribution was affected by the relative position of the sprinkler heads to the ceiling joists.

3. STABILITY TESTS.

A sprinkler head was subjected to sudden variation of water pressure up to over 500 lbs. per sq. in. (*33·3 atms.*) by about twelve jerks on the lever of an hydraulic pump shown on Fig. No. 4.

On examining this sprinkler head after the above test, both before and after taking it to pieces, it was found that the valve seating remained unaffected, and in fact that the sprinkler head itself and all its parts were unimpaired.

OBSERVATIONS TAKEN FROM POINTS NOS. 1, 2.

(*From* 5.43 *p.m. to* 5.46 *p.m.*)

FIRE TEST No. 1. SPRINKLER HEADS INVERTED.

Temperatures recorded by Pyrometer.

July 28th, 1904.

Time.	Point No. 1.	Point No. 2.	Seconds Elapsed.
	Deg. Fahr.	Deg. Fahr.	
5.43 p.m.	80°	85°	0
	100	90	
	110	92	
	125	105	
	(*51·6° C.*)	(*40·5° C.*)	
5.44 p.m.	130	115	60
	146	120	
	156	130	
	164	144	
	(*73·3° C.*)	(*62·2° C.*)	
5.45 p.m.	174	146	120
	184	160	
	188	166	
	193	168	
	204	178	
	205	182	
	(*96·1° C.*)	(*83·3° C.*)	
5.46 p.m.	212	186	180
	212	193	
	223	197	
5.47 p.m.	222*	—*	240
	(*105·5° C.*)	(*91·6° C.*)	

* Both Sprinklers opened. Whistle blown.

(*From* 6.45 *p.m. to* 6.48 *p.m.*)

FIRE TEST No. 2. SPRINKLER HEADS PENDENT.

Temperatures recorded by Pyrometer.

July 28th, 1904.

Time.	Point No. 1.	Point No. 2.	Seconds Elapsed.
	Deg. Fahr.	Deg. Fahr.	
6.45 p.m.	80°	80°	0
	110	130	
	113	136	
	117	140	
	(51·6° C.)	(60° C.)	
6.46 p.m.	125	140	60
	125	154	
	132	162	
	140	170	
	144	174	
	158	182	
	168	195	
	(75·5° C.)	(90·5° C.)	
6.47 p.m.	170	198	120
	182	204	
	188	212	
	195	215	
	196	220	
	202	227	
6.48 p.m.	210*	228*	180
	(98·8° C.)	(108·8° C.)	

* Both Sprinklers opened. Whistle blown.

Note.—This table shows that the temperature increased more rapidly than in the first test. Although the air of the hut at commencement was of the same temperature in each case the walls, being still warm from the heat of the first test, absorbed heat less freely.

SUPPLEMENTARY TESTS

Supplementary tests made on October 26, 1904, with Albion Automatic Sprinkler Heads, for sensitiveness, in the glass box and under all conditions described on pages 12 and 13. Sprinkler heads in each case pendent.

OBSERVATIONS TAKEN DURING THE TESTS.

Minutes Elapsed.		Pipes not charged with Water. Temperatures.		Pipes charged with Water Pressure at Sprinkler Head about 10 lbs. per sq. in. (0·56 atms.) Temperatures.	
		Test No. 1.	Test No. 3.	Test No. 2.	Test No. 4.
Mins.	Secs.	Deg. Fahr.	Deg. Fahr.	Deg. Fahr.	Deg. Fahr.
0		48° (8·8° C.)	74° (23·3° C.)	73° (22·7° C.)	71° (21·6° C.)
1		76	125	110	118
2		118	160	142	144
3		136	180	157	172
4		148 (64·4° C.)	185 (85° C.)	164 (73·3° C.)	185 (85° C.)
4	16	—	Sprinkler	—	—
5		149	opened	170	192
5	20	—	leaving	—	(88·8° C.)
6		160	outlet free.	174	Sprinkler
7		166 (74·4° C.)	—	178 (81·1° C.)	opened leaving
8		168	—	180	outlet free.
9		172	—	183	—
9	57	177 (80·5° C.)	—	—	—
10		Sprinkler opened	—	184 (84·4° C.)	—
11		leaving	—	186	—
12		outlet free.	—	188 (86.6° C.)	—
12	29	—	—	Sprinkler opened leaving outlet free.	—
Note.—		Tests commenced: 2·24 p.m.	3·13 p.m.	2·48 p.m.	3·34 p.m.

Note.—During the tests Nos. 3 and 4 the pressure of gas supply to the gas stove considerably increased, which explains the more rapid rise in temperature shown by these tests.

Note.—The sprinkler heads used had links of Copper Nickel.

GENERAL ARRANGEMENTS.

The test was carried out according to the procedure laid down by the Executive for investigations of this description, and conducted by a Sub-Committee of the Executive, comprising:—

Mr. James Sheppard,* A.Inst.E.E., Surveyor North British and Mercantile Insurance Co. (Directing Member).

Mr. Percy Collins.*

Mr. Lionel Langridge, A.M.Inst.E.E.

Assisted by

Mr. H. G. Cooke * (Commercial Union Assurance Company).

Mr. R. Ray.*

Mr. H. B. White, M.Inst.E.E., superintended in the Instrument Room.

The Council was represented by :—

Major-General E. R. Festing, C.B., F.R.S.

The Executive was represented by :—

Mr. Edwin O. Sachs,* F.R.S.Ed. (Chairman).

Mr. Max Clarke, F.R.I.B.A.

Mr. Herbert Dyer * (Vice-President National Fire Brigades' Union).

Mr. Ellis Marsland * (District Surveyor, Camberwell).

Mr. T. W. Restler,* M.Inst.C.E.

The General Body of Members was represented by :—

Mr. William Grellier, F.R.I.B.A. (District Surveyor, Clapham); Mr. Geo. McDonell (District Surveyor, Islington); Mr. E. J. A. Fulkes; Mr. Frank Sumner (Borough Surveyor and Engineer, Plumstead); and Mr. Bernard Dicksee, A.R.I.B.A. (District Surveyor, East Newington), etc.

Note.—* indicates attendance at Supplementary Test of October 26, 1904.

Messrs. The Albion Sprinkler Co., Ltd., were represented by :—

Mr. R. F. G. Baxandall, A.M.Inst.M.E.; Mr. J. Cuthbertson; Mr. J. C. Day; Mr. H. B. Muir; Mr. J. J. Pulleine; Mr. M. Williams.

The following visitors attended by special invitation of the Executive :—

Mr. John P. Bishop (Carlton Hotel); Mr. N. Elliott (Architects' Dept., L.C.C.); Lieut.-Col. Fox, F.R.G.S. (London Salvage Corps); Mr. S. G. Gamble, A.M.Inst.C.E. (Second Officer, Metropolitan Fire Brigade); Mr. E. W. F. Grellier, Jun.; Mr. Thomas Hoad; Mr. Geo. Ridout; Mr. J. Stransom's Deputy (Theatres Branch, L.C.C.); Mr. W. Tidman.

Signed,

For the Sub-Committee in charge of Tests:
JAS. SHEPPARD.

For the General Testing Arrangements Sub-Committee :
ELLIS MARSLAND.

For the Executive :
EDWIN O. SACHS (*Chairman*).

Published by the Committee as directed by the Executive.
CHAS. ADAMI
(*Assist. Secretary*).
Date—November 2, 1904.

Verified a true copy of the Report ordered to be published,
ROSE-INNES, SON & CRICK (*Solicitors*).
Date—November 11, 1904.

A LIST OF THE COMMITTEE'S PUBLICATIONS, REPORTS, ETC. CAN BE OBTAINED UPON WRITTEN APPLICATION TO THE ASSISTANT SECRETARY, 1 WATERLOO PLACE, LONDON, S.W.

UNWIN BROTHERS, LIMITED, THE GRESHAM PRESS, WOKING AND LONDON.

ations of the
BRITISH FIRE PREVENTION COMMITTEE—No. 88.
t by the Executive.

IRE TESTS WITH PARTITIONS.

A PARTITION

FORMED WITH

"KULM" PARTITION SLABS,

AND ERECTED BY

HORACE W. CULLUM & CO.,

LONDON

The Committee's Report.

ALL RIGHTS RESERVED.

LONDON, 1904.

PUBLISHED AT THE OFFICES OF
THE BRITISH FIRE PREVENTION COMMITTEE
(Founded 1897—Incorporated 1899),
1, WATERLOO PLACE, PALL MALL.

Two Shillings and Sixpence

OBJECTS OF THE COMMITTEE:

The main objects of the Committee are :—

To direct attention to the urgent need for increased protection of life and property from fire by the adoption of preventive measures.

To use its influence in every direction towards minimising the possibilities and dangers of fire.

To bring together those scientifically interested in the subject of Fire Prevention.

To arrange periodical meetings for the discussion of practical questions bearing on the same.

To establish a reading-room, library and collections for purposes of research, and for supplying recent and authentic information on the subject of Fire Prevention.

To publish from time to time papers specially prepared for the Committee, together with records, extracts, and translations.

To undertake such independent investigations and tests of materials, methods and appliances as may be considered advisable.

The Committee's Reports on Tests with Materials, Methods of Construction, or Appliances are intended solely to state bare facts and occurrences, with tables, diagrams, or illustrations, and they are on no account to be read as expressions of opinion, criticisms, or comparisons.

The Committee is not responsible for the views of individual authors as expressed in Papers or Notes, but only for such observations as are formally issued on behalf of the Executive.

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Vice-Chairman of the Industrial Section:

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Regent Street, S.W.

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WESTBOURNE LODGE, BAYSWATER, W.

Offices:

1, WATERLOO PLACE, PALL MALL, LONDON, S.W.
(CHARLES ADAMI, *Assistant Secretary*)

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With the addition of

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Sub-Committees comprise Members of the Executive with Assistance from the General Membership.

The Chairman and Hon. Secretary of the Executive are ex officio *members of all Sub-Committees.*

NOTE.

This report deals with a partition which was tested with the view of ascertaining whether it could be classified as affording "Partial Protection" (Class B), under the Committee's Universal Standards of Fire Resistance.

In order to be thus classified the thickness of the Partition under investigation is at the maker's option, the superficial area to be tested must be at least 80 sq. ft., and the duration of the fire test is 120 minutes at a temperature increasing to 1,800° Fahr., the fire tests being followed by the application of water for two minutes.

The thickness of the Partition was $3\frac{1}{8}$ in.

J. HERBERT DYER.

LONDON,

September 26th, 1904.

THE GENERAL ARRANGEMENTS FOR TESTS.

(MEMORANDUM.)

THE purpose of the tests undertaken by the British Fire Prevention Committee is to obtain reliable data as to the exact fire-resistance of the various materials, systems of construction, or appliances used in building practice.

The tests are of an entirely independent character, arranged on scientific lines, but with full consideration for the practical purpose in view. Absolute reliability is assured, records being mostly taken automatically, or by photography, and the temperatures being easily regulated by the application of gas.

All reports on tests solely state the bare facts and occurrences, with tables, diagrams, and illustrations, and on no account are reports to be taken as including expressions of opinion, nor should any expression be read as a comparison or criticism.

The general arrangement and direction of the tests are in the hands of the Executive, who act in accordance with certain principles laid down after careful study and experiment. The official tests are attended by the members of the Council and the members of the Committee in rotation.

As to the Committee's present Testing Station, it comprises a house, standing in its own grounds, near Royal Oak Station, and backing on to the Great Western Railway. The principal building is used for Committee Rooms and laboratory purposes, whilst the gardens are utilised for so-called "full-size" tests.

As to the financial aspect of the station, the establishment expenses are being met by a special subscription. As far as the funds of the committee permit, investigations and experimental tests with ordinary (*i.e.*, not patented) forms of construction are undertaken from time to time and duly reported on. Official tests with patented materials, makers' systems, etc., etc., are subject to a scale of charges, but these charges are so figured as to only just cover the actual cost. The Testing Station is also open to members for such private research work or tests they may desire to undertake.

The services of the members participating in the management of the station, conducting or attending tests, are given entirely gratuitously.

For the Executive,

EDWIN O. SACHS, *Chairman.*

Fig. 9. THE PARTITION. VIEW AFTER TEST (FROM INSIDE).

of 10 ft. (*3·048 m.*). The thickness of the partition was $3\frac{1}{8}$ in. (*0·79 m.*)

Note.—The time allowed for the construction and drying of the partition was fourteen days.

SUMMARY OF TEST.

No effect of the fire was visible on the passage side, and there was no buckling of the partition nor any cracks visible.

The fire and smoke did not pass through the partition or joints.

The recorded temperature in the passage on the outside of the partition at no time exceeded 210° Fahr. (*98·8° C.*).

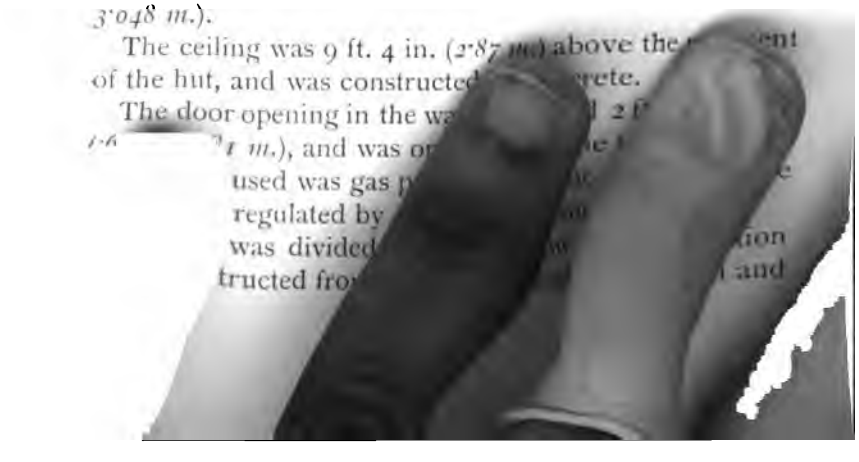
The effect caused by the application of water was to knock off portions of the plastering on fire side, and to cause dampness to show on the passage side.

DESCRIPTION OF TESTING PLANT.

(*See Figs. 1 to 4.*)

The Testing Chamber used was located at the Committee's Testing Station, and was known as "No. 2 Hut."

The hut was constructed as shown of stock bricks, with lime mortar, and measured 10 ft. by 10 ft. (*3·048 m.* × *3·048 m.*).


The ceiling was 9 ft. 4 in. (2·87 m.) above the
of the hut, and was constructed
The door opening in the wa
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OFFICIAL REPORTS

OF THE

British Fire Prevention Committee

[FOUNDED 1897—INCORPORATED 1899].

FIRE TEST NO. 52—JULY 28TH, 1904.

A PARTITION

FORMED WITH

"KULM" PARTITION SLABS,

FIXED BY

HORACE W. CULLUM & CO.,

LONDON.

OBJECT OF TEST.

To record the effect of a fire of two hours' duration at a temperature gradually increasing to 1,800° Fahr. (*982·2° C.*), and not to exceed 2,000° Fahr. (*1,093·3° C.*), followed by the application of water for two minutes on the fire side with the view of being classified as affording "Partial Protection" (Class B).

Note.—The area of the partition under investigation was to be at least 75 ft. superficial (*6·97 sq. m.*), with a width

of 10 ft. (*3·048 m.*). The thickness of the partition was 3¼ in. (*0·79 m.*)

Note.—The time allowed for the construction and drying of the partition was fourteen days.

SUMMARY OF TEST.

No effect of the fire was visible on the passage side, and there was no buckling of the partition nor any cracks visible.

The fire and smoke did not pass through the partition or joints.

The recorded temperature in the passage on the outside of the partition at no time exceeded 210° Fahr. (*98·8° C.*).

The effect caused by the application of water was to knock off portions of the plastering on fire side, and to cause dampness to show on the passage side.

DESCRIPTION OF TESTING PLANT.

(*See Figs. 1 to 4.*)

The Testing Chamber used was located at the Committee's Testing Station, and was known as "No. 2 Hut."

The hut was constructed as shown of stock bricks, with lime mortar, and measured 10 ft. by 10 ft. (*3·048 m.* × *3·048 m.*).

The ceiling was 9 ft. 4 in. (*2·87 m.*) above the pavement of the hut, and was constructed of concrete.

The door opening in the wall measured 2 ft. by 6 ft. 6 in. (*·61* × *1·981 m.*), and was open during the test.

The fuel used was gas produced at the station, and the supply was regulated by valves and dampers.

The hut was divided as shown on plan, the partition being constructed from north to south, the full width and

height of the hut, leaving the passage on the outside 1 ft. 10 in. (·558 *m.*) wide.

The gas was admitted through two mixing chambers of fire-brick, each 7 ft. 9½ in. by 3 ft. 3 in. (2·374 × ·990 *m.*) as shown.

Two Roberts-Austen pyrometers were used for recording temperatures, one taking a continuous record from point No. 5 and one being used for the observation

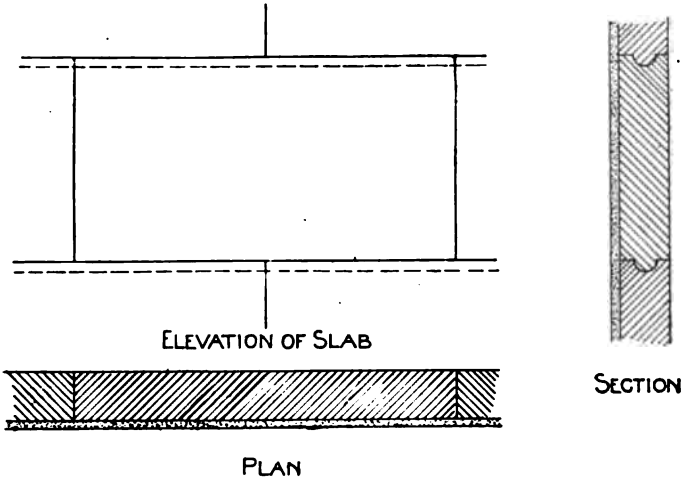

Fig. 5. THE PARTITION SLABS.

records at points No. 1, 2, 3, and 4. Points Nos. 1, 4, 5 were inside the chamber, and Nos. 2 and 3 outside in the passage.

There were two observation holes, one in the north and one in the south walls, and two small observation holes in the west wall.

The stream of water was applied to the inside face of partition through the observation hole on the south side, by a branch with ¾ in. (·019 *m.*) nozzle, and supplied from a small steam fire engine.

CONSTRUCTION OF THE PARTITION.

(See Figs. Nos. 1 to 5.)

Plans, elevations, and sections of the partition are shown.

On July 14th, 15th, and 16th the partition was being erected.

The slabs forming the partition were built on the floor of the hut, and carried up to the underside of the concrete ceiling, the height of the partition being 9 ft. 0 in. (*2·793 m.*) The partition, including plastering, was $3\frac{1}{8}$ in. thick (*·079 m.*), built of slabs 21 in. by $11\frac{3}{8}$ in. by $2\frac{3}{4}$ in. (*·533 × ·288 × ·068 m.*)

The slabs were tongued and grooved horizontally, the vertical joints being square (see detail).

The partition was plastered on the fire side.

Joints were made with equal parts of plaster of Paris and fire-clay (*·012 m.*), the partition was plastered on the fire side with plaster composed of fire-clay, sand, and plaster of Paris, average $\frac{3}{8}$ in. (*·009 m.*) thick.

The Passage side of the partition was not plastered, but the joints of slabs were made good and brushed over with a wash of fire-clay, sand, and plaster of Paris.

A coke fire was lighted on Monday, July 25th, and kept burning during each day until the following Wednesday.

The slabs are stated by the maker to be composed of pumice stone, volcanic sand, and Portland cement, and to weigh about 14 lbs. (*6·35 kg.*) per square foot (*·30 □ m.*).

The slabs were built upon a course of bricks laid on the floor of the hut, and finished against ceiling, a plaster fillet being fixed to break joint on both sides and along ceiling (see plan).

Note.—A heavy thunderstorm occurred two nights before the test, when the tarpaulin was ineffectual in entirely keeping out the rain, whereby a corner of the partition was wetted and contained an abnormal amount of moisture.

THE TEST.

On July 28th, 1904, the test was undertaken. The following is a log of the test :—

At 3 p.m. the meteorological observations taken at the Botanic Gardens, Regent's Park, read as follows :—

"State of weather, cloudy ; Wind, S.W. ; Barometer, 30·02 inches (·762 *m.*) ; attached thermometer, 68° Fahr. (*20·0 C.*) ; Wet Bulb, 63° Fahr. (*17·20 C.*) ; Dry Bulb, 68·5° Fahr. (*20·2 C.*). Remarks : Fine, warm afternoon."

At 3·30 p.m. Gas lighted.

OBSERVATIONS ON THE OUTSIDE.

		Minutes Elapsed.
3·55 p.m.	Partition beginning to steam. Temperature on outside face 120° Fahr. (*54·4 C.*).	25
4.10 p.m.	Partition continuing to steam.	40
4.20 p.m.	Steaming less.	50
4.30 p.m.	Steaming very little.	60
4.45 p.m.	Steam almost disappeared.	75
5·0 p.m.	Steam disappeared.	90
5.15 p.m.	First change in partition noted, a small crack appearing in joint.	105
5.30 p.m.	No change in partition had taken place except the slight crack referred to, no smoke had come through, and the partition was intact.	120

Figs. 6 AND 7. THE PARTITION (FROM OUTSIDE).

VIEW BEFORE TEST. VIEW DIRECTLY AFTER TEST.

Fig. 8. THE PARTITION (FROM OUTSIDE).

VIEW TWO DAYS AFTER TEST.

Observations on the Inside.	Minutes Elapsed.
3.45 p.m. A number of little black spots appeared on surface of plastering.	15
3.52 p.m. Most of these spots appear to have burnt out.	22
3.55 p.m. Small hair cracks in north side one joint from bottom.	25
3.59 p.m. Cracks had now disappeared.	29
4.10 p.m. Small blister in plastering about 18 in. (*·45 m.*) from south side, and 18 in. (*·45 m.*) (*45 m.*) from bottom.	40
4.23 p.m. Small hair cracks in plastering again appeared.	53
4.42 p.m. Small blisters in plastering about 48 in. (*1·21 m.*) from bottom, and 18 in. (*·45 m.*) from south side.	72
5.25 p.m. A diagonal crack in plastering appeared, about 2 ft. (*·61 m.*) from bottom, and extended to 4 ft. (*1·22 m.*), and then followed course of joint.	115
5.28 p.m. A number of black spots appear in plastering at bottom.	118
5.30 p.m. Gas turned off, and water turned on to the inside face of the partition for a space of two minutes, which knocked off portions of plastering on south side and on passage side dampness showed in two spots, but the joints were all perfect.	

Observations taken from Points Nos. 1, 2, 3, 4.

From 3.30 p.m. to 5.30 p.m.

Time.	Inside.		Outside (in Passage).		Minutes Elapsed.
	No. 1.	No. 4.	No. 2.	No. 3.	
	Deg. Fahr.	Deg. Fahr.	Deg. Fahr.	Deg. Fahr.	
3.30 p.m.	—	—	—	—	—
3.35 „	845	980	—	—	5
3.40 „	1040	1140	—	—	10
3.45 „	1220	1280	—	—	15
	(*660·0 C.*)	(*693·3*)			
3.50 „	1330	1350	—	—	20
3.55 „	1460	1450	100	120	25
4.0 „	1460	1450	120	180	30
	(*793·3*)	(*787·7*)	(*48·8*)	(*82·2*)	
4.5 „	1500	1500	140	180	35
4.10 „	1540	1520	130	166	40
4.15 „	1610	1600	150	180	45
	(*876·6*)	(*871·1*)	(*65·5*)	(*82·2*)	
4.20 „	1640	1640	150	170	50
4.25 „	1660	1660	150	180	55
4.30 „	1715	1725	180	210	60
	(*935·0*)	(*940·5*)	(*82·2*)	(*98·8*)	
4.35 „	1750	1760	190	210	65
4.40 „	1750	1800	200	215	70
4.45 „	1820	1800	200	220	75
	(*993·3*)	(*982·2*)	(*93·3*)	(*104·4*)	
4.50 „	1820	1825	180	210	80
4.55 „	1830	1870	180	210	85
5.0 „	1840	1870	180	200	90
	(*1004·4*)	(*1021·1*)	(*82·2*)	(*93·3*)	
5.5 „	1880	1890	180	200	95
5.10 „	1900	1900	170	200	100
5.15 „	1940	1950	180	200	105
	(*1060·0*)	(*1065·5*)	(*82·2*)	(*93·3*)	
5.20 „	1960	1980	180	210	110
5.25 „	1970	2000	190	210	115
5.30 „	1990	2010	180	210	120
	(*1087·7*)	(*1098·8*)	(*82·2*)	(*98·8*)	

* Degrees in italics are Centigrade.

The following is the record taken from the Continuous Record at Points No. 5 :—

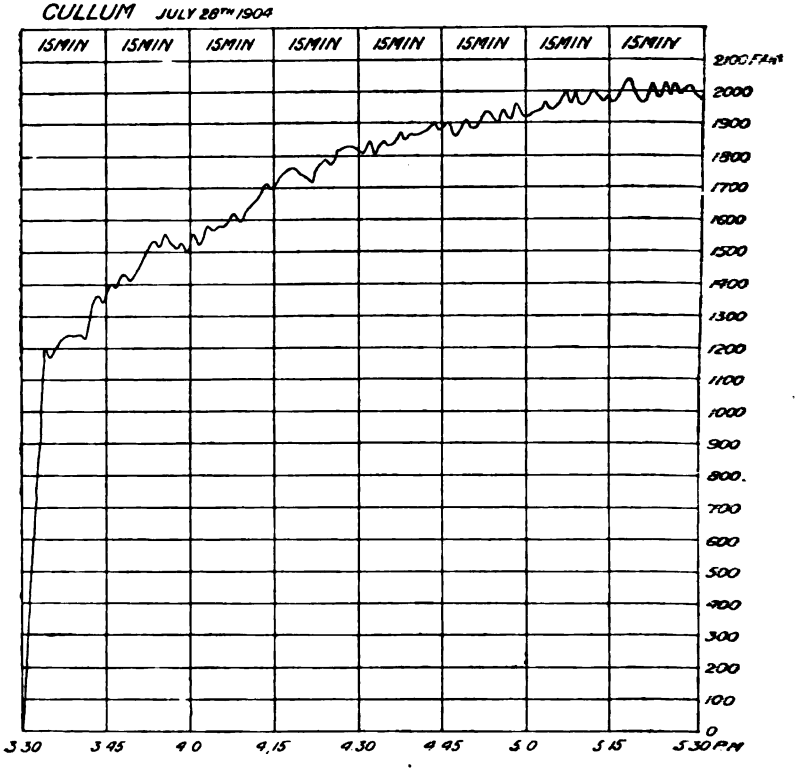

Fig. 10.

OBSERVATIONS AFTER THE TEST.

On August 3rd, the following observations were made: The passage side was intact and had apparently undergone no change, except that there were two slight cracks each about 12 ins. long (·*304 m.*), one near the floor and one near the ceiling (as before described).

The fillets against walls were perfect on the passage side, but portions only remain on the inside.

The inside face of partition showed several vertical and horizontal cracks (see photograph) and about one fourth of the plastering was knocked off by the water jet.

Where the water knocked off the plastering, the surface of the slabs was eroded to a depth of about $\frac{3}{4}$ in. (·019 *m.*). The remainder of the plastering was in position, but very friable, as also was the face of the partition under same. The partition could be vibrated by pressure in the centre.

GENERAL ARRANGEMENTS.

The Test was carried out according to the procedure laid down by the Executive for investigations of this description, and conducted by a Sub-Committee of the Executive, comprising :—

Mr. J. Herbert Dyer, Vice-President N.F.B.U. (Directing Member).
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Mr. A. H. Lister assisted the Sub-Committee.
Mr. H. B. White, M.Inst.E.E., superintended in the Instrument Room.

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Messrs. H. W. Cullum & Co. were represented by :—

Mr. Horace Cullum, Mr. C. A. Hood.

The following visitors attended by special invitation of the Executive :—

Mr. John Bishop (Carlton Hotel); Mr. H. G. Cooke; Mr. J. C. Day; Mr. N. Eliiott (Architects' Dept., L.C.C.); Lieut. Col. Fox, F.R.G.S. (London Salvage Corps); Mr. E. W. F. Grellier, Jun.; Mr. Thomas Hoad; Mr. Robert Ray; Mr. Geo. Ridout; Mr. I. Schnuetzen; Mr. J. Stransom's Deputy (Theatre Branch, L.C.C.); Mr. W. Tidman.

Signed,

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For the General Testing Arrangements Sub-Committee :—

ELLIS MARSLAND.

For the Executive :

EDWIN O. SACHS.

Published by the Committee as directed by the Executive.

C. ADAMI.

Date—September 26th, 1904.

Verified a true copy of the Report ordered to be published.

ROSE-INNES, SON AND CRICK.

Date—October 3rd, 1904.

LIST OF

The British Fire Prevention Committee's

PUBLICATIONS.

1. WHAT IS FIRE PROTECTION? A Study. By EDWIN O. SACHS.
2. AMERICAN OPINIONS ON FIRE PREVENTION. Abstracts from Papers. By EDWARD ATKINSON and others.
3. THE PARIS BAZAAR FIRE. A Paper, with Illustrations By EDWIN O. SACHS.
4. THEATRE EXITS. A Paper. By ALFRED DARBYSHIRE, F.S.A., F.R.I.B.A.
5. NEW YORK FIRE DEPARTMENT. A Paper, with Illustrations. By HUGH BONNER, Chief Officer, New York.
6. COTTON FIRES AND COTTON BALES. A Paper, with Illustrations. By R. H SCOTTER, C.E.
7. FIRE-RESISTING FLOORS USED IN LONDON. A Paper, with Illustration. By FREDERICK FARROW, F.R.I.B.A.
8. FIRE SERVICE IN FACTORIES, WORKS, ETC. A Paper, with Illustrations. By HAROLD SUMNER.
9. LESSONS FROM FIRE AND PANIC. A Paper. By THOMAS BLASHILL, F.R.I.B.A., F.S.I., Superintending Architect to the London County Council.
10. HOW TO BUILD FIREPROOF. A Paper By FRANCIS C. MOORE, President of the Continental Insurance Co., New York.
11. FIRE TESTS WITH UNPROTECTED COLUMNS. A Report by the Committee on "Fire-Proofing" Tests, New York.
12. THE EFFECT OF FIRE. A Report on the Horne Building Fire, Pittsburg, U.S.A., with Fourteen Plates and Illustrations.
13. THE B.F.P.C. TESTING STATION. Some Descriptive Notes, with Illustrations
14. FIRE TESTS WITH FLOORS. A Floor by the Expanded Metal Co.
15. CONFLAGRATIONS DURING THE LAST TEN YEARS. A Paper, with Twenty-Three Maps. By CHARLES E. GOAD, M.Am.Soc.C.E.
16. FIRE TESTS WITH FLOORS. A Floor of Wood Joists filled in with Concrete.
17. THE TALL BUILDING UNDER TEST OF FIRE. A Paper, with Illustrations. By H. de B. PARSONS.
18. FIRE TESTS WITH FLOORS. A Floor of Solid Wood Beams.
19. FIRE TESTS WITH CEILINGS. A Ceiling by the Asbestos and Asbestic Co.
20. FIRE TESTS WITH GLASS. Three Casements by the British Luxter Prism Syndicate.
21. FIRE TESTS WITH FLOORS. A Floor of Steel Joists, filled in with Concrete on Corrugated Iron, with a Suspended Ceiling.
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24. FIRE TESTS WITH DOORS. A 2-in. Solid-framed Teak Door; a 1-in. Four-panel Pine Door; a 1-in Four-panel Pine Door.
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26. FIRE TESTS WITH DOORS. A 2-in. Framed Oak Door, with 2-in. Solid Panel; a 2-in. Framed Teak Door, with 2-in. Solid Panels.
27. FIRE TESTS WITH PARTITIONS. A Match-boarded Partition filled in with Silicate Cotton (Slag Wool) by Messrs. T. Anderson & Son, and Messrs. T. Broadbent & Co.
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32. FIRE TESTS WITH GLASS. Two Skylights glazed with Wired Glass by Messrs. Pilkington Bros.
33. FIRE TESTS WITH GLASS. A Casement glazed with ¼-in. Plate Glass; a Casement glazed with 32 oz Sheet Glass; a Casement glazed with "Lead Lights."
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36. FIRE TESTS WITH TREATED WOOD. "Non-Flammable" Wood by the British Non-Flammable Wood Company, Ltd., London.
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38. FIRE TESTS WITH FLOORS. A Floor by the "Gypsine" Brick Co., Ltd., London and Paris.
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List of the Fire Prevention Committee's Publications—*continued.*

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50. FIRE TESTS WITH DOORS. A 2⅜-in. Door of Archangel Deal constructed in Three Thicknesses; a 1⅜-in. Door of Teak, Flush Panelling on each side, the Panels being in Two Thicknesses. Particulars of Experimental Fire Tests.
51. FIRE TESTS WITH FIRE-RESISTING CURTAINS. Two Fire Blinds, known as the "Williams" Fire Blinds, installed by G. A. Williams & Son, Bayswater, London. The Committee's Report
52. FIRE TESTS WITH PARTITIONS. A Partition formed with "Mack's" Patent Slabs, and erected by M. J. A. King & Co., London. The Committee's Report.
53. FIRE TESTS WITH PARTITIONS. A Partition known as the "Cunnah-Wright" Partition, by the Fireproof Partition Syndicate, Ltd., London. The Committee's Report.
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BRITISH FIRE PREVENTION COMMITTEE.—No. 89.

ited by the Executive.

FIRE TESTS WITH LAMPS

A LAMP

CALLED THE

PETROLITE LAMP,

MANUFACTURED BY

PETROLITE, LIMITED,

LONDON.

The Committee's Report.

ALL RIGHTS RESERVED.

LONDON, 1904.

PUBLISHED AT THE OFFICES OF
THE BRITISH FIRE PREVENTION COMMITTEE
(Founded 1897—Incorporated 1899),
1, WATERLOO PLACE, PALL MALL.

Two Shillings and Sixpence.

OBJECTS OF THE COMMITTEE:

The main objects of the Committee are :—

To direct attention to the urgent need for increased protection of life and property from fire by the adoption of preventive measures.

To use its influence in every direction towards minimising the possibilities and dangers of fire.

To bring together those scientifically interested in the subject of Fire Prevention.

To arrange periodical meetings for the discussion of practical questions bearing on the same.

To establish a reading-room, library and collections for purposes of research, and for supplying recent and authentic information on the subject of Fire Prevention.

To publish from time to time papers specially prepared for the Committee, together with records, extracts, and translations.

To undertake such independent investigations and tests of materials, methods and appliances as may be considered advisable.

The Committee's Reports on Tests with Materials, Methods of Construction, or Appliances are intended solely to state bare facts and occurrences, with tables, diagrams, or illustrations, and they are on no account to be read as expressions of opinion, criticisms, or comparisons.

The Committee is not responsible for the views of individual authors as expressed in Papers or Notes, but only for such observations as are formally issued on behalf of the Executive.

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Sub-Committees comprise Members of the Executive with Assistance from the General Membership.

The Chairman and Hon Secretary of the Executive are ex officio *members of all Sub-Committees.*

NOTE.

This is the first test of a lamp for burning mineral oil undertaken by the Committee, and it is to be observed that the Committee's tests were entirely confined to the lamp after it had been filled and lighted.

Many accidents occur during the process of filling a lamp with oil in the ordinary way, and knowing the importance of this process of filling, the Committee have added an Appendix (with photographs) showing the method recommended by the manufacturer for filling their lamp, which matter—from the point of view of protection from fire—is almost of as much importance as the actual safety of the lamp itself after it is filled and lighted.

ELLIS MARSLAND.

LONDON,

November 2nd, 1904.

THE GENERAL ARRANGEMENTS FOR TESTS.

(MEMORANDUM.)

THE purpose of the tests undertaken by the British Fire Prevention Committee is to obtain reliable data as to the exact fire-resistance of the various materials, systems of construction, or appliances used in building practice for the detection and extinction of fire.

The tests are of an entirely independent character, arranged on scientific lines, but with full consideration for the practical purpose in view. Absolute reliability is assured, records being mostly taken automatically, or by photography, and the temperatures being easily regulated by the application of gas.

All reports on tests solely state the bare facts and occurrences, with tables, diagrams, and illustrations, and on no account are reports to be taken as including expressions of opinion, nor should any expression be read as a comparison or criticism.

The general arrangement and direction of the tests are in the hands of the Executive, who act in accordance with certain principles laid down after careful study and experiment. The official tests are attended by the members of the Council and the members of the Committee in rotation.

As to the Committee's present Testing Station, it comprises a house, standing in its own grounds, near Royal Oak Station, and backing on to the Great Western Railway. The principal building is used for Committee Rooms and laboratory purposes, whilst the gardens are utilised for so-called "full-size" tests.

As to the financial aspect of the station, the establishment expenses are being met by a special subscription. As far as the funds of the committee permit, investigations and experimental tests with ordinary (*i.e.*, not patented) forms of construction are undertaken from time to time and duly reported on. Official tests with patented materials, makers' systems, etc., etc., are subject to a scale of charges, but these charges are so figured as to only just cover the actual cost. The Testing Station is also open to members for such private research work or tests they may desire to undertake.

The services of the members participating in the management of the station, conducting or attending tests, are given entirely gratuitously.

For the Executive,

EDWIN O SACHS, *Chairman.*

OFFICIAL REPORTS

OF THE

British Fire Prevention Committee

[FOUNDED, 1897.—INCORPORATED, 1899.]

FIRE TEST No. 55.—JULY 28TH, 1904.

A LAMP

CALLED THE

PETROLITE LAMP,

AND MANUFACTURED BY

PETROLITE, LTD.,

LONDON.

OBJECT OF TEST.

To test the safety of a lamp in the event of its being upset by accident or otherwise, also its liability to explode or give off explosive vapour after burning for a given period.

Note.—Seven Lamps of identical pattern were to be tested.

SUMMARY OF EFFECT.

The lamps stood the several tests made by the Committee as detailed, and on no occasion did the lamp fail to go out when upset, and no spirit escaped.

DESCRIPTION OF LAMP.

(*See Figs.* A, *and* 6 *to* 19A.)

The Petrolite Lamp is an apparatus in which the air is automatically and continuously carburetted by being made to pass in a downward direction through a receptacle charged with absorbent non-combustible material, saturated with light hydro-carbon (Petroleum Spirit), such receptacle being immediately below the burner, and the carburetted air being raised through a tube direct to the burner from the absorbent material by the heat of combustion in the chimney or funnel.

The draught is started by applying a lighted match through an opening at the bottom of the chimney, or by inserting a lighted taper downwards in the chimney from the top, and the carburetted air thus drawn up will immediately ignite.

The regulation of the lamp is carried out by the simple arrangement of turning one lever only, which simultaneously controls the air inlet to the carburetter, the carburetted air exits from the carburetter to the burner tube, and the air supply to the latter.

The following is the maker's detailed description of the lamp with reference to the accompanying drawing :—

Fig. A shows a sectional view of the lamp tested. Figs. 6 to 17 are elevations or cross-sections of the single parts thereof. Figs. 19 and 19A are photographic views of parts of the Lamp, and Fig. 18 is a photographic view of one of the lamps tested.

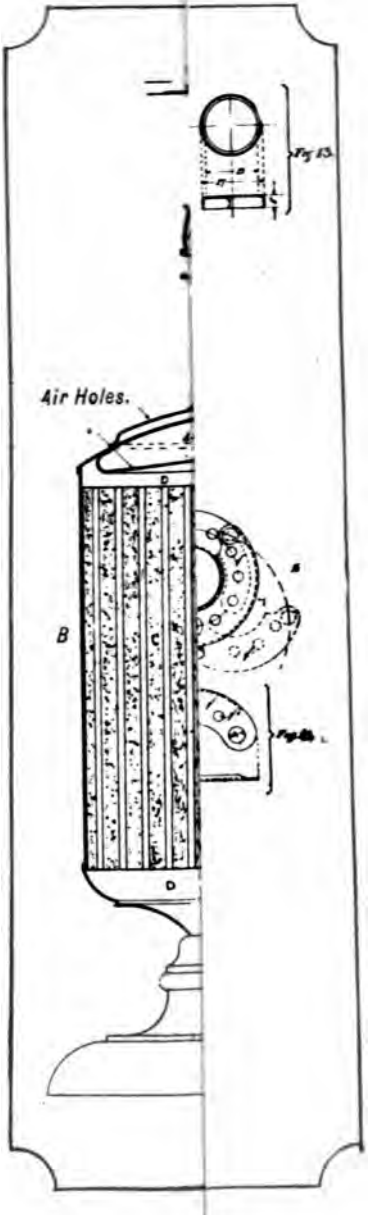


Fig 13.
Air Holes.
B
D
D

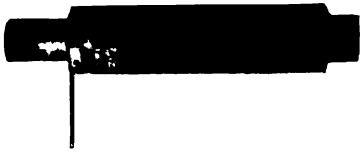
Within the Container B there is placed a perforated block C, of absorbent incombustible material, the perforations, as shown, running from the top to the bottom of the block.

The burner tube (8) is sunk within the centre of the carburetter B, the lower end of the tube being provided with lateral openings (*a*) and (*a*¹) for the admission of carburetted air from below the perforated absorbent block C.

The centre of the carburetter is provided with an outer metal tube (10) passing down nearly to the bottom of the carburetter. At the upper end of the outer tube, and within the carburetter and above the absorbent block, lateral openings (*d*) are provided for the admission of air to the carburetter. At its lower end this tube is contracted, and has fixed to it a sleeve (7), one half of which projects within the end of this tube (10) and one half

Fig. 18.—*The Lamp.*

below it. The burner tube (8) is fitted within this sleeve (7), the burner tube projecting above the top of the outer tube (10), leaving an annular space (G) between the two tubes (8) and (10). The lower half of the sleeve (7) is provided with two opposite lateral openings (d^2) through which the carburetted air passes from the carburetter into the burner tube (8), which is provided with corresponding openings (a).



Figs. 19 *and* 19A.—*Details of Lamp.*

The upper part of the sleeve (7) is provided with lateral openings (d^3) as indicated in dotted lines, by which air may be drawn from the annular space (G) into the burner tube (8). These two sets of openings are opened and closed by giving a motion of partial rotation to the burner tube (8) by the rod or lever (5). The bottom of the sleeve (7) is closed.

These two sets of openings, upper and lower, are so arranged that when the carburetted air openings, viz., the lower openings (d^2) and (a) are full open, the air inlet openings, viz., the upper set (d^3 and a^1) are closed, and *vice versâ*, or if the lower set is partially opened, the upper is also partially opened. The lateral openings (d) from the upper part of the outside tube (10) for the admission of air to the carburetter, are regulated by an inner movable sleeve (4) provided with corresponding openings (c), the said sleeve (4) being rotated

along with the burner tube (8) by means of the lever (5). Sleeve (4) is fixed to the inner tube (8), rotating both together by means of a fixed lever (5). The opening and closing of the air inlet openings (*d*) and (*e*) to the carburetter are made to coincide with the opening and closing of the lower set of openings (d^2) and (*a*), leading from the carburetter into the burner tube.

The burner proper fits over the top of the burner tube (8) in such a way as not to obstruct the admission of air to the annular space (G).

The burner is carried directly on the top of the burner tube (8) by means of the burner sleeve (14) fitting over it.

Fig. (16) is a plan of the chimney holder, and for the purpose of applying a lighted match, taper or torch to the burner top, the chimney holder is provided with the orifice (*f*). The said orifice may be closed after the lamp is lit by means of the pivoted arm piece f^1, air apertures or perforations (f^2) being provided as shown, and which limit the free admission of air to the inside of the chimney.

When the lamp is in action the draught from the chimney draws air through the apparatus, this air entering at the open top of the annular space (G). The air enters the top of the carburetter by the openings *d*, *e*, passes down through the channels (*b*) of the absorbent block, where it becomes carburetted and enters the burner tube (8) by the lower set of openings (d^2 and *a*).

When the apparatus a^1 and d^3 are open, air also passes down the annular space (G) to these apertures, and through these apertures into the burner-tube (8), where it mixes with the carburetted air which enters by the lower apertures (*a*, d^2). By suitably regulating the proportions of carburetted air and ordinary air by rotating the inner tube, a mixture is obtained suitable for the production of a flame such as is required for use with an incandescent mantle.

The light is obtained by the combustion of the carburetted air playing upon an incandescent mantle.

THE TESTS.

On July 28th the following tests were made in the hall of the main building of the Committee's Testing Station. The hall had a tile floor, and an ordinary wood table was used.

	RESULTS.
TEST No. 1. A lamp in accordance with the foregoing description was placed on a table and gently tipped over and rolled off the table on to the floor.	The glass and mantle were broken and the lamp went out.
TEST No. 2. The same conditions obtained as No. 1, but the lamp was forcibly overturned.	The glass and mantle were broken and the lamp went out.
TEST No. 3. The same conditions as No. 1, but the lamp was rolled on to some muslin and shavings laid upon the floor.	The mantle was broken and the lamp went out.
TEST No. 4. The same conditions as No. 1, but the lamp was forcibly overturned on to the muslin and shavings.	The mantle was broken and the lamp went out.

TEST No. 5.	*RESULTS.*
A lamp was kept burning for 30 minutes and then extinguished, the chimney and mantle were removed, the valve was reopened, and a light applied.	No ignition took place.
TEST No. 6.	
The valve of a lamp was left turned on for 30 minutes in an ordinary temperature, the chimney and mantle being removed a light was applied.	No ignition took place.
TEST No. 7.	
A jet of water was applied to a lighted lamp.	The chimney and mantle were broken, and the lamp was extinguished.

GENERAL ARRANGEMENTS.

The test was carried out according to the procedure laid down by the Executive for investigations of this description, and conducted by the Chairman of the Testing Arrangements Sub-Committee of the Executive:—

Mr. Ellis Marsland, District Surveyor, Camberwell (*Directing Member*).

Assisted by—

Mr. Bernard Dicksee, A.R.I.B.A., District Surveyor (on behalf of the Testing Arrangements Sub-Committee).

Major-General E. R. Festing, C.B., F.R.S. (on behalf of the Council).
Mr. J. W. Restler, M.Inst.C.E., Metropolitan Water Board (on behalf of the Executive).
Mr. E. J. A. Fulkes, Royal Insurance Company (on behalf of the General Body of Members).

The lamps were demonstrated on behalf of Petrolite, Ltd., by :—

Dr. Hugh Marshall, D.Sc., F.R.S.Ed., Edinburgh University.

The Executive was represented by :—

Mr. Edwin O. Sachs, F.R.S.Ed. (Chairman).
Mr. Herbert Dyer (Vice-President National Fire Brigades' Union).
Mr. James Sheppard, A.Inst.E.E. (North British and Mercantile Insurance Co.).
Mr. Langridge, A.M.Inst.E.E.

The General Body of Members was represented by :—

Mr. Wm. Grellier, F.R.I.B.A. (District Surveyor, Clapham) ; Mr. Geo. McDonell (District Surveyor, Islington) ; Mr. Frank Sumner (Borough Engineer and Surveyor, Plumstead).

Messrs. Petrolite, Ltd., were represented by :—

Ernest F. Brown, A.I.M.E. ; Thomas H. Cramp ; James Elliott ; Alfred Jaray, A.I.E.E. ; Henry L. Satow ; Frank Suter, A.I.E.E.

The following visitors attended by special invitation of the Executive :—

Mr. John P. Bishop ; Mr. H. G. Cooke ; Mr. J. C. Day ; Mr. N. Elliott (L.C.C.) ; Lieut.-Col. Fox, F.R.G.S. (London Salvage Corps) ; Mr. E. W. F. Grellier, Jun. ; Mr. Thos. Hoad ; Mr. Robert Ray ; Mr. Geo. Ridout ; Mr. J. Schuntzen ; Mr. J. Stransom's Deputy (L.C.C.) ; Mr. W. Tidman.

Signed,

For the General Testing Arrangements Sub-Committee :

ELLIS MARSLAND (*Directing Member*).

For the Executive :

EDWIN O. SACHS (*Chairman*).

Published by the Committee as directed by the Executive.

CHARLES ADAMI (*Assist. Secretary*).

Date—November 2nd, 1904.

Verified a true Copy of the Report, ordered to be published,

ROSE-INNES, SON & CRICK (*Solicitors*).

Date—November 12th, 1904.

APPENDIX TO REPORT.

Method of Filling Lamp.

The method of "filling the lamp" is of course a great point in its use, and the manufacturer has devised a method with a similar lamp, but with a removable container whereby he considers that danger is reduced to a minimum.

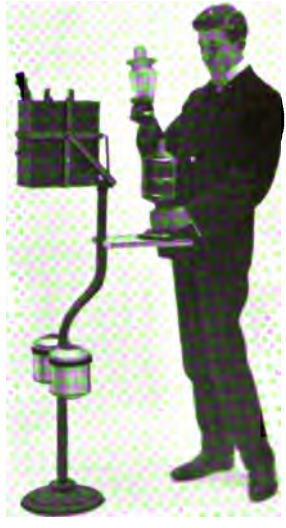
As the method of filling lamps is one that does not lend itself to the recording of facts by tests, and presentation of opinions on such questions are outside the purview of the Committee, the Manufacturer's views are presented without comment or endorsement of any kind.

The following description and photographs illustrate the method advocated by the manufacturers with a lamp with a removable container. Figs. 20 to 23.

To charge the carburetter the container has to be taken out of the lamp (as illustrated in Figs. 20 to 23). This container has a threaded ring on the top. It is known that all petrol cans (as used for motor cars, &c.), have an outlet with a screw cap of a universally adopted standard; the container can, by means of an adapter supplied with the lamp, be screwed direct on to the petrol can (Figs. 24 to 33). To charge the container, the can is simply tilted and the petrol runs into the carburettor. After the absorbent incombustible material in the container has been allowed a moment in which to get thoroughly saturated, the can is tilted back and a little time allowed for the surplus liquid to drain back into the vessel (see Figs. 24 to 33). The container is then unscrewed and put back into the lamp, while the screw cap of the vessel is replaced on the top of the adapter ready for the next use.

Special cradles to take the petrol cans can be obtained to make the charging most simple, and these cradles are mounted on a stand or on a bracket so arranged that they

Take Lamp to Charging Stand.
Fig. 24.



Lift off Top.
Fig. 25.

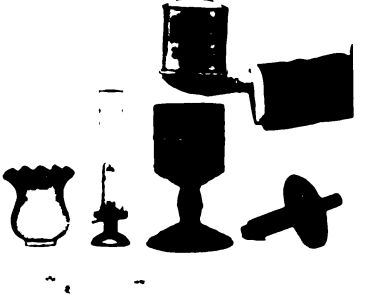
Tilt Can and let Petrol run in Container, wait a minute till well saturated.
Fig. 29.

Tilt Can back, and allow a minute for Surplus Liquid to draw back into Can.
Fig. 30.

›ff Lamp Top and lift out Container complete.
Fig. 20.

Pull out Burner Tube.
Fig. 22.

Unscrew Container.
Fig. 21.



This is the Container Tin, to be Charged.
Fig. 23.

may be fixed to the outside of the house to ensure the charging of the lamps being carried out there (see Figs. 24 to 33).

There are also cans designated "safety cans," which are designed to prevent any danger of explosion in the event of a fire or other cause, thus intended to remove the most dangerous element in connection with inflammable gaseous fluids. These cans, the use of which is advocated by the manufacturers, may be compared in their action to the Davy lamp, but applied to cans, drums, or tanks. A wire gauze safety tube, surrounded by a double sheath of perforated metal, is fixed in the vessel, reaching to the bottom and closely packed at the top opening.

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THE

SIXTH ANNUAL REPORT

PRESENTED BY

THE EXECUTIVE

OF THE

BRITISH FIRE PREVENTION COMMITTEE.

With an Appendix Comprising

THE EXECUTIVE'S SUGGESTIONS

ON THE

AMENDMENT OF THE LONDON BUILDING ACT

AND

VARIOUS NOTES

For Use of the Membership

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LONDON, 1905.

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THE BRITISH FIRE PREVENTION COMMITTEE
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Two Shillings and Sixpence.

OBJECTS OF THE COMMITTEE:

The main objects of the Committee are :—

To direct attention to the urgent need for increased protection of life and property from fire by the adoption of preventive measures.

To use its influence in every direction towards minimising the possibilities and dangers of fire.

To bring together those scientifically interested in the subject of Fire Prevention.

To arrange periodical meetings for the discussion of practical questions bearing on the same.

To establish a reading-room, library and collections for purposes of research, and for supplying recent and authentic information on the subject of Fire Prevention.

To publish from time to time papers specially prepared for the Committee, together with records, extracts, and translations.

To undertake such independent investigations and tests of materials, methods and appliances as may be considered advisable.

The Committee's Reports on Tests with Materials, Methods of Construction, or Appliances are intended solely to state bare facts and occurrences, with tables, diagrams, or illustrations, and they are on no account to be read as expressions of opinion, criticisms, or comparisons.

The Committee is not responsible for the views of individual authors as expressed in Papers or Notes, but only for such observations as are formally issued on behalf of the Executive.

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. E. NOVERRE, London Manager, Norwich Union Fire Office.
SIR W. HENRY PREECE, K.C.B., F.R.S., late Engineer-in-Chief, General Post Office; Past-Pres. Inst. of Civil Engineers.
JOHN PRICE, M.Inst.C.E., F.S.I., City Surveyor, Birmingham.
GUY PYM, J.P., D.L., M.P., North British and Mercantile Insurance Company.
BOVERTON REDWOOD, F.R.S.Ed., F.I.C., Advisor on Petroleum to the Home Office.
W. E. RILEY, F.R.I.B.A., The Architect, London County Council.
E. G. RIVERS, I.S.O., M.Inst.C.E., Chief Engineer H.M. Office of Works.
ALEXANDER SIEMENS, M.Inst.C.E., President, Inst. Electrical Engineers.
SIR JAMES WEEKS SZLUMPER, M.Inst.C.E.
SIR JOHN TAYLOR, K.C.B., Consulting Architect H.M. Office of Works.
ROBERT VIGERS, Past-President, The Surveyors' Institution.
A. WHITELEGGE, C.B., M.D., F.R.C.P., Chief Inspector of Factories, Home Office.
SIR JAMES WILLIAMSON, C.B., Director of H.M. Dockyards.
SIR HENRY TRUEMAN WOOD, M.A., Secretary, Society of Arts.

Executive:

MAX CLARKE, F.R.I.B.A.; CHARLES E. GOAD, M.Am.Soc.C.E., M.Can.Soc.C.E.;
LIONEL J. LANGRIDGE, A.M.Inst.E.E.; PERCY COLLINS;
ROBERT MOND, M.A., F.R.S.Ed.; J. HERBERT DYER, Vice-Pres. N. F. B. U.
JAMES SHEPPARD, A.Inst.E.E., Surveyor North British and Merch. Ins. Co.;
J. W. RESTLER, M.Inst.C.E., late Chief Eng., Southwark and Vauxhall Waterworks;
E. de SEGUNDO, A.M.Inst.C.E., A.M.I.Mech.E.

Gen. Hon. Secretary:

ELLIS MARSLAND, District Surveyor.

Hon. Auditors:

LIEUT.-COL. GEORGE W. DIXON, V.D., F.S.I E., Vice-Pres. Nat. Fire Brigades' Union.
HORACE S. FOLKER, F.A.I., Gen. Hon. Sec. Nat. Fire Brigades' Union.

Bankers:

LONDON AND SOUTH WESTERN BANK,
Regent Street, W.

Testing Station:

WESTBOURNE LODGE, BAYSWATER, W.

Offices:

1, WATERLOO PLACE, PALL MALL. LONDON, S.W.
(CHARLES ADAMI, *Assistant Secretary.*)

THE KING'S MESSAGE TO THE MEMBERS

OF THE

INTERNATIONAL FIRE PREVENTION CONGRESS

CONVENED BY

THE EXECUTIVE OF THE BRITISH FIRE PREVENTION COMMITTEE

JULY, 1903.

"The King sincerely trusts that the deliberations of this important and representative body will lead to a further development as to the best means to be adopted in regard to the prevention of fire and to the saving of life in cases of fire."

NOTE.

The present Publication contains the Sixth Annual Report of the Executive and gives a summary of the work done in the year 1904 in a more elaborate form than heretofore. Some idea of the difficulties encountered in the execution of the Committee's operations, both from a technical and financial point of view, may thus be obtained, particularly, if read in conjunction with the first Quinquennial Report issued at the close of 1903.

These Reports will show that even in these days of strenuous competition there are a number of professional men ready to take up and voluntarily work at a subject, which they believe to be of utility to the community at large, though perhaps even somewhat opposed to their direct personal interests.

As an appendix to the Sixth Annual Report, some addenda have been added comprising the Suggestions made by the Executive on behalf of the Committee, at the invitation of the London County Council as to the Amendment of the London Building Act, and further, a list of the Journals kept on file by the Committee, a list of the Committee's Publications, and some memoranda regarding the conduct and cost of Fire Tests, all notes which may be of some use to the members.

In conclusion, it may be well to point out that with the past year, 1904, the Committee entered upon what is hoped will prove to be a new lease of life with a strengthened Council and Executive.

EDWIN O. SACHS (*Chairman*).
ELLIS MARSLAND (*Gen. Hon. Secretary*).

WATERLOO PLACE,
LONDON, S.W.
1st March, 1905.

SPECIAL SUB-COMMITTEES

OF THE

EXECUTIVE.

The General Purposes, Finance and Rules Sub-Committee.

EDWIN O. SACHS, A.cht., *Chairman.*
ELLIS MARSLAND, Distr. Surveyor; JAMES SHEPPARD, A.Inst.E.E.;
With the addition of
HORACE FOLKER, F.A.I., Gen. Hon. Sec., N.F.B.U.

The Testing Arrangements Sub-Committee.

ELLIS MARSLAND, Distr. Surveyor, *Chairman.*
MAX CLARKE, F.R.I.B.A.; J. HERBERT DYER, Vice-Pres. N.F.B.U.;
LIONEL J. LANGRIDGE, A.M.Inst.E.E.; ROBERT MOND, M.A.;
J. W. RESTLER, M Inst.C.E.;
EDWIN O. SACHS, Archt (*ex officio*); E. de SEGUNDO, M.I.Mech.E.;
With the addition of
BERNARD DICKSEE, A.R.I.B.A., Distr. Surveyor.
W. GRELLIER, F.R.I.B.A., Distr. Surveyor.

The Library and Museum Sub-Committee.

JAMES SHEPPARD, A.Inst.E.E., *Chairman.*
PERCY COLLINS; CHARLES E. GOAD, M.Am.Soc C.E.;
ELLIS MARSLAND, Distr. Surveyor (*ex officio*); EDWIN O. SACHS, Archt. (*ex officio*);
E. D. SEGUNDO, M.I.Mech.E.

The Parliamentary Sub-Committee.

EDWIN O. SACHS, Archt., *Chairman.*
MAX CLARKE, F.R.I.B.A.; ELLIS MARSLAND, Distr. Surveyor;
J. W. RESTLER, M.Inst.C.E.; JAMES SHEPPARD, A.Inst.E.E.
With the addition of
HORACE FOLKER, F.A.I., Gen. Hon. Sec., N.F.B.U.
A. WALMISLEY, M.Inst.C.E., Chief Eng. Dover Harbour Board.

Sub-Committees comprise Members of the Executive with Assistance from the General Membership.

The Chairman and Hon. Secretary of the Executive are ex officio *members of all Sub-Committees.*

THE

British Fire Prevention Committee.

[FOUNDED 1897—INCORPORATED 1899].

SIXTH ANNUAL REPORT

(*FROM JANUARY* 1, 1904, *TO DECEMBER* 31, 1904.)

PRESENTED BY

THE EXECUTIVE.

Formation.

The Committee was incorporated as a Technical Society six years back, *i.e.*, in February, 1899, after having passed through a preliminary period of nearly a year and a quarter. The formal foundation dated from November, 1897, on the occasion of the great Cripplegate Fire. A summary of the Committee's work to December 31, 1903, was prepared in the form of the Quinquennial Report.

The Year Generally.

The year 1903 had been one of the greatest activity for the Committee, owing to the International Fire Prevention Congress which it had convened, and the International Fire Exhibition, in respect to which the Committee organised the Technical and Historical side.

The very considerable amount of time devoted to the work of 1903 by the members of the Committee and its Executive necessitated the year 1904 being a comparatively quiet one.

Nevertheless the year 1904 was an important one in the annals of the Committee, owing to the general administrative development of the Committee's affairs and to the initiation of several new departures in its work.

Tests.

The Committee has continued its investigations as to the fire resistance of materials, and system of construction, by undertaking various tests, namely with four Partitions, a Sprinkler, and a Petroleum Lamp.

The six tests for the year 1904 bring the total number of tests conducted by the Committee to 85.

The series of Partition tests will be continued during 1905.

Standards of Fire Resistance.

The Standards of Fire Resistance for Floors, Partitions, and Doors, framed by the Committee and accepted as Universal Standards by the International Fire Prevention Congress, 1903, have been translated into the German and French languages, English figures, weights, and temperatures being given their metric equivalent. These Standards, together with some special tables of English measurements, weights, and temperatures, converted into their metric equivalents, have been issued as a publication of the Committee (Red Book No. 82).

The conversion of the figures and preparation of the tables was undertaken by Mr. Max Clarke, F.R.I.B.A., and the translations by Chief Officers Dittman (Bremen) and Welsch (Ghent), Hon. Foreign Corresponding Members of the Committee.

Reports and Publications.

The Reports of the various Tests undertaken during 1904 were issued from time to time in six Red Books, bringing the number of the Committee's Red Books dealing with Tests to 63. During the year there have also been issued four publications on other matters relating to the prevention of fire, notably a record of the Iroquois Theatre Fire of Chicago. The total number of ordinary publications, *i.e.*, Red Books comprising either reports or papers on the subject of Fire Prevention, has risen from 79 to 89.

The Metric System.

The Committee has continued to adopt in its reports

on tests the metric system introduced in 1903, side by side with the English system, in order to enhance the International utility of its publications.

Special Commission to visit Central Europe.

The Committee during 1904 formed a Special Commission to visit Central Europe upon the occasion of the International Fire Service Congress, at the invitation of the Hungarian Fire Brigades' Union.

This Commission was formed in co-operation with the National Fire Brigades' Union, and comprised the Committee's Chairman as Chairman of the Commission, the General Honorary Secretaries of the Union, and the Committee as Hon. Secretaries of the Commission, and three Executive Officers of each body.

The cities visited were in order of rotation—Vienna, Pressburg, Budapesth, Salzburg, Munich, Nuremburg, Frankfort, and Cologne.

The Commissioners met with a most cordial reception, and their visit was of a highly instructive character.

The Technical Notes and Diary of the Commission was issued in February, 1905, in form of an illustrated Record.

On the return journey of the Commission the Chairman and a member of the Executive took the opportunity to visit the scene of the great Petroleum Fire at Antwerp, and particulars of this fire are appended to the Record.

International Fire Service Council.

The Committee has, in co-operation with the National Fire Brigades' Union and the Association of Professional Fire Chiefs, arranged for the suitable representation of Great Britain on the International Fire Service Council, upon which Great Britain has been allotted twelve seats, including two Founder's seats. The remaining ten seats have been allotted as follows, namely : Three seats to the National Fire Brigades' Union, three seats to the British Fire Prevention Committee, three

*

seats to the Association of Professional Fire Brigade Officers, and one seat to the Salvage Service.

The three representatives of the Committee upon the International Fire Service Council attended the Council's General Meeting at Budapesth.

The Chairman of the Committee was re-elected Vice-President of the International Fire Service Council for a period of four years.

Various Services rendered to Public Authorities.

The Committee has continued to render various services to the Public Authorities when called upon.

The Chairman of the Committee was requested by the Secretary of State for Home Affairs to report upon the International Fire Congress held at Budapesth, and afterwards to present certain information relating to the Antwerp Petroleum Fire of August last.

The Executive prepared and presented to the London County Council, observations in respect to the proposed amendment of the London Building Act, and has further been called upon to express its views as to the Bill deposited in Parliament.

The Committee's International Fire Library.

The nucleus of books which existed at the Committee's office has been developed into a library of considerable technical importance.

This library will be known as the International Fire Library, formed by the Committee, and already comprises, approximately, 3,000 items.

The number of technical journals kept on file at the Committee's offices in connection with the Library, is 102, apart from the official Journals or Transactions of technical societies.

It is anticipated that the International Library will eventually become a most important feature of the Committee's work, and will probably have its own International Advisory Council, whilst being managed

by a Library Managing Sub-Committee of the Committee.

Collections.

The Committee have continued its collection of relics and photographs of materials tested, with a view of eventually forming a Museum, and are also anxious to obtain good photographs and plans of notable fires for this collection.

Distinctions accorded to the Committee.

The Committee has exhibited at the Hygienic and Life-Saving Exhibition at the Grand Palais d'Elyseé of Paris, organised under the patronage of the French Government, and it has been accorded the distinction of a diploma for the Gold Medal of the Exhibition.

The Committee's New Journal.

The great conflagrations and other occurrencies of technical importance during 1904 made it apparent to the Executive that an additional form of publication should be attempted beyond the issue of the Committee's ordinary Red Books, which do not lend themselves to the reproduction of numerous large illustrations. It was further considered probable that the Committee would eventually from time to time wish to publish items of information, and should have some publication that would serve as a means of intercommunication between its members.

The Committee has thus commenced the issue of a Quarterly Journal, 4to size, the first of which deals specially with the Baltimore conflagration; the second of which deals with the Record of the Special Commission to Central Europe; and the third will probably deal with a series of investigations which are being conducted in the United States with fire-resisting materials.

It is hoped that this Quarterly Journal may eventually be developed into a monthly publication, embodying all

the Committee's printed matter, other than the reports upon the Committee's tests, which it is deemed advisable should be kept to their present form, as 8vo. Red Books.

Subscriptions to the Publications and Journal by Non-Members.

The Executive, having found that there was a certain demand for the regular perusal of its publications outside its own membership, has authorised that subscriptions to the Committee's publications can be accepted, such subscription, however, not according the Subscriber any other rights beyond the receipt of such of the Committee's printed matter as is public.

This arrangement for subscribing to the Committee's publications it is hoped will appeal to Public Authorities, who, whilst, as a rule, being precluded from becoming members of a technical Society, are thus able to obtain the necessary information by ordinary subscription to the Red Books and Journal.

New Members of Council and Executive.

The year 1904 was notable for the strengthening of the Committee's Council by a number of influential members, most of whom had been actively associated with the Committee's work on the occasion of the International Fire Service Congress and Exhibition of 1903.

The Committee's Executive was strengthened by the membership electing four new members, comprising a Civil Engineer, a Mechanical Engineer, an Insurance expert, and a Volunteer Fire Brigade Officer.

The Executive's new Sub-Committees.

The work of the Executive was, to a certain extent, more divided up than formerly by the formation of standing Sub-Committees, which are as follows, namely, A General Purposes and Finance Sub-Committee, a Library Managing Sub-Committee, a General Testing Arrangements Sub-Committee, and a Parliamentary Sub-Committee. The Sub-Committees have received the

assistance of several gentlemen from the general membership of the Committee.

Work of the Executive Members.

There were sixteen meetings of the Executive in 1904. The number of standing Sub-Committee meetings held were as follows: General Purposes, 4; Library, 5; Testing Arrangements, 3. The Parliamentary Sub-Committee had no occasion to meet.

There were six special Sub-Committees entrusted with the conduct of and report upon official tests.

There were three Testing Days during the year, requiring the attendance of members of the Executive.

Executive meetings lasted, on the average, 2¾ hours.

The Standing Sub-Committee meetings lasted, on the average, 2¼ hours.

The average time that had to be occupied by the Special Testing Sub-Committees was three afternoons.

Voluntary Work.

All this work, as has already been indicated in previous reports, is done voluntarily, and in all instances the workers bear their own expenses.

The Committee's Articles.

During the year the Committee's Articles were altered so as to enable the election of members of Council and members of the Executive by Postal Ballot. This was considered necessary owing to the extended area over which the Committee's membership has now spread, including the Provinces and the Colonies.

Lists issued.

The tables as to the comparative results of the series of door tests has been prepared by the Gen. Honorary Secretary, and will shortly be issued. A classified list of the Committee's Publications has been issued. The various general circulars and printed matter of the Committee have been brought up to date during the year and reissued.

First Hon. Members.

In recognition of the very great services rendered to the Committee by Mr. Horace Folker, the General Hon.

Secretary of the National Fire Brigades' Union, and by Lieut.-Col. Dixon, V.D., one of the Vice-Presidents of the National Fire Brigades' Union, these two gentlemen, both being members, were unanimously elected the first two Honorary Members of the Committee.

New Hon. Corresponding Members abroad.

Arising out of the visit to Central Europe, the Committee has elected four honorary corresponding members: one Hungarian and three Germans.

Members.

The ordinary membership of the Committee, after allowing for deaths and resignations, increased from 256 to 277. There are also the above-mentioned 2 honorary members, and 55 hon. corresponding members. The total membership is thus 334.

Non-Member Subscribers.

The number of subscribers (non-members) is 49.

Financial Arrangements.

The financial arrangements of the Committee continued to give the Executive cause for anxiety, more particularly owing to the heavy expenditure incurred specifically in connection with the International Fire Congress of 1903 upon which there had been a considerable loss.

There was, however, some slight relief in the anxiety, due to the fact that as far as the actual revenue and expenditure for the current year's working was concerned, there was no deficit for the actual twelve months' working of 1904. This is the first occasion in the history of the Committee that there has been no deficit on the actual working of a year.

The deficit as is well known during the first five years, has been very considerable, *i.e.*, some £5,000 mainly met by the Standing and Temporary Loans provided by individual members of the Executive.

The reason for the absence of any new—*i.e.*, additional —deficit for the working of the current twelve months, is two-fold.

The first of these reasons is certainly pleasurable as it comprises the increase in income from subsciptions, sales of Publications, etc., on the one hand ; and on the other, the reduction of the current expenses, which have been reduced by rigid economy, and by the fact that various members of the Executive have voluntarily taken additional routine work upon their shoulders, and have also frequently given the gratuitous assistance of their private staffs.

The second reason is, however, not as pleasurable, inasmuch as it is that the Testing operations have had to be limited to tests with proprietary articles, the Committee not undertaking any tests with systems of construction or materials in common use, which tests, undertaken out of the Committee's funds, had been a source of considerable expenditure. It is regrettable that these tests in respect to work in ordinary building practice should have been stopped for 1904, but it is obvious that it was expedient for the Committee to avoid creating further deficiencies, more particularly as the individual members of the Executive could not be expected to continue putting their hands in their pockets to provide the Committee either with further gifts or with loans.

Financial Assistance rendered by Members of the Executive.

As a matter of fact, the Loan Account of the Committee in respect to monies provided by members of the Executive is £2,460 standing loans and £1,000 temporary loans—together £3,460—and this is already far more than should ever have been provided by professional men in a matter of such public importance, where they are already called upon to give considerable personal services, and do everything that is required absolutely gratuitously—*i.e.*, gratuitously in its fullest sense—that they receive no payment of any kind, and do not even have their out-of-pocket expenses refunded.

It is hoped that by a continuance of the rigid economy and voluntary assistance of members of the Executive,

even in matters of routine by their private staffs, a further increase of the original deficit to the end of 1903, and increase of the loans thereby occasioned may be avoided, and that gradually all trade liabilities may be cleared off. As to the standing loans, it may be possible to find a way to turn the major portion into permanent charges redeemable only after a considerable number of years, as has been the case in several other technical Societies.

Financial Support necessary.

As time progresses and the membership and subscription to the Committee's publications increase, it should be possible to put the Committee on a sound basis as to current income and expenditure, but it is to be hoped that the importance of the subject, which has been so emphasised by the terrible loss of life and the many catastrophes of 1904, will eventually lead some philanthropists to leave the beaten track of the ordinary channels for liberality and take up this subject, which is one of the utmost importance in more than one direction, and perhaps place the Committee in a stronger position financially. Its scope could thereby be immediately extended in many directions.

New Testing Station required.

The Executive would here specially point out that the uncertain tenure upon which the testing station is necessarily held will probably shortly involve its change of location. It would then be of great advantage to place the station upon the Committee's own freehold, or upon a site that can be leased for a considerable period, so as to avoid any further moving. For this either a gift of land or money should be obtained, and it is to be hoped that when the time comes such a gift will be forthcoming.

Accounts.

The Executive's Annual Statement of Receipts and Payments for the year 1904 is appended as before, with the Hon. Auditors' Certificate.

Deceased Members.

It is with great regret that the Executive record the

eath of Mr. J. A. MacDonald, M.Inst.C.E., late chief ngineer of the Midland Railway Co., who had only ccupied a seat on the Council of the Committee for a ew months, and who was the first chief engineer of a ailway Company to take an active interest in the ommittee's operations.

The Executive further record with great regret the leath of one of the Founders of the Committee, Mr. Thomas Blashill, F.R.I.B.A., late Superintending Architect to the London County Council. Mr. Blashill was one of the first members of the Council, and in the arly days of the Committee took a most active interest n its work, and was always ready to give assistance.

The Executive further record with great regret the leath of Chief Officer Giersberg, of the Berlin Royal Police Fire Brigade, as Hon. Cor. Member of the Committee, who was held in great esteem, and frequently rendered this body invaluable assistance. He deservedly held the Committee's insignia, "Pro bono publico," in recognition of the great services he had rendered in the interests of the fire preventive movement.

Acknowledgments.

The Executive has, as heretofore, had considerable assistance from members and others interested in the various sections of the Committee's work, which kind assistance they wish to specially acknowledge.

On behalf of the Executive, as authorised on March 1, 1905.

EDWIN O. SACHS (*Chairman*).
ELLIS MARSLAND (*Gen. Hon. Secretary*).

1, Waterloo Place,
Pall Mall, London, S.W. *March* 1, 1905.

**

The British Fire Prevention Committee.

THE EXECUTIVE'S ANNUAL STATEMENT OF RECEIPTS & PAYMENTS FOR 1904.

The Executive presents, herewith, the Annual Statements of Receipts and Payments for the Year 1904.

In order to simplify the accounts, the two separate accounts known previous to 1903 as the General Account and the Testing Station Account have been amalgamated.

On behalf of the Executive, as authorised on March 1, 1905.

EDWIN O. SACHS (*Chairman*).
ELLIS MARSLAND (*Gen. Hon. Secretary*).

COMBINED GENERAL AND TESTING STATION ACCOUNT.

Summary of Receipts and Payments for the Year ending December 31, 1904.

Dr. RECEIPTS.	£	s.	d.	Cr. PAYMENTS.	£	s.	d.
To Balance brought forward from last year	43	19	2	By Working Expenses...	1035	7	4
,, Income from various sources ...	1592	11	6	,, Reduction in Temporary Loans to £1000	81	17	4
,, Library Sub-Committee, Special Donations	2	2	0	,, Congress Cont'ngent Liabilities ... 228 10 8			
				,, *Less* discharged in 1903 ... ... 13 6 9			
					215	3	11
				,, Congress Special Deficit a/c ...	221	0	0
				,, Library Sub-Committee's a/c ...	75	19	11
				,, Balance forward to next year ...	9	4	2
	£1638	12	8		£1638	12	8

I have examined the above Statement of the Committee's Account, and have duly vouched the same and verified the Bank Balances, and hereby certify the correctness thereof. In addition to the Loans owing on December 31, 1904, there were on that date debts for goods and otherwise, amounting to £1850 16s. 4d. Two hundred and forty-six First Mortgage Debenture Bonds of Ten Pounds each (part of an issue of £7,500 authorised by the Committee) are held as security for certain of these debts.

(*Signed*)
HORACE S. FOLKER,
Hon. Auditor.

I have examined the accounts mentioned in the above certificate with Mr. Horace S. Folker and such vouchers as I have called for, and I am satisfied as to the correctness of the same.

(*Signed*)
GEO. W. DIXON,
Hon. Auditor.

16th day of January, 1905.

MEMORANDUM

as to the

CONDUCT AND COST OF FIRE TESTS.

THE purpose of the tests undertaken by the British Fire Prevention Committee is to obtain reliable data as to the exact fire-resistance of the various materials and systems of construction used in building practice, and to give precise particulars regarding fire-alarm, or fire-extinguishing appliances.

The tests are of an entirely independent character, arranged on scientific lines, but with full consideration for the practical purpose in view. Absolute reliability is assured, records being mostly taken automatically, or by photography, and the temperatures being easily regulated by the application of gas.

All reports on tests solely state the bare facts and occurrences, with tables, diagrams, and illustrations, and on no account are reports to be taken as including expressions of opinion, nor should any expression be read as a comparison or criticism.

The general arrangement and direction of the tests are in the hands of the Executive, who act in accordance with certain principles laid down after careful study and experiment. The official tests are attended by the members of the Council and the members of the Committee in rotation.

The testing station comprises a house standing in its own grounds, the building being used for Committee rooms and the gardens utilised for the testing chambers and furnaces.

Parties interested in fire-resisting materials, systems of construction, or appliances, can apply for tests subject to a scale of charges which varies according to the subject put forward for investigation and the preparations necessary. These charges are intended to cover in part or whole the expenses incurred upon the tests after due allowance for the establishment charges incurred in the maintenance of the station, the

cost of the issue of the official illustrated report of the test to the members of the Committee and the general clerical labour, etc., involved.

The actual *skilled conduct and supervision of the tests, as also the preparation of the reports by the members, is undertaken voluntarily;* no fees of any kind, or even out-of-pocket expenses, being paid to the members of the Committee for such services.

Seventy-nine tests have been completed and reported upon up to January 1, 1904. These tests have been undertaken in the course of 59 testing operations and embodied in 57 reports (Red Books).

The direct outlay upon the testing station and execution of the 79 tests to January 1, 1904, was £6,507 2s. 6d., to which must be added one half of the general expenses of the Committee, *i.e.*, the necessary proportion to meet the head office charges, including photography, draughtmanship, clerical assistance, stationery, and the printing and illustrating of the reports. Thus £3,510 8s. 9d., must be added to the figures £6,507 2s. 6d., making a total of £10,017 11s. 3d.

If this figure be divided by 79 it will be found that each test has cost on the average in round figures £127. If it be divided by 59, being the number of testing operations that were required in order to conduct the 79 tests—several minor ones of which were undertaken simultaneously in the same testing operation—it will be found that the cost per testing operation was, on the average, in round figures £169 15s.

The Committee's scale of charges ranges from £65 to £185, the average charge being £125, and, with some few exceptions, the tests with proprietary matter involved a separate testing operation. Thus, apart from the gratuitous services rendered in supervision, the testors' payments did not generally cover the cost of the fire tests undertaken.

On behalf of the Executive,
EDWIN O. SACHS, *Chairman.*
ELLIS MARSLAND, *Gen. Hon. Secretary.*

LONDON, 1905.

SUGGESTIONS FOR AMENDMENT

OF THE

London Building Act, 1894,

BY THE EXECUTIVE OF THE

British Fire Prevention Committee.

THE CLERK,
TO THE LONDON COUNTY COUNCIL,
SPRING GARDEN, S.W.

DEAR SIR,

Proposed Amendment of the London Building Act, 1894.

In reference to your kindly communication of January 22, at the instance of the Building Act Committee notifying that they will be pleased to consider any suggestions which the British Fire Prevention Committee may submit in respect to the proposed amendment to the London Building Act, we now have the honour to hand you an interleaved copy of the Act as it stands, with our Executive's proposals indicated therein.*

Our Executive wish us to say that they have solely considered the Act from the Fire Prevention point of view, and their observations are thus limited to matters of fire protection.

They wish us to point out that they have accorded various matters of small detail considerable attention, having regard to the fact that some of these minor safeguards have in practice been found of vital importance.

They have also dealt at some length with Schedule 2 of the existing Act, making the proposals based upon recent experiments.

There is one general observation which our Executive desire to make and emphasise, and that is that they consider it essential that the new Act should be retrospective regarding buildings used entirely or partly for purposes of manufacture, warehousing, wholesale or retail trade, but think there should be a very ample margin of time for the execution of such retrospective requirements, so that the financial difficulties

* See page 22.

***

and inconveniences to owners and occupiers would be reduced to a minimum.

In framing any retrospective clauses relating to escape from fire, the Executive wish us to again point to their previous observations, namely, that they consider that outside balconies and ladders would in numerous cases give adequate security, and at the same time materially facilitate the work of the Fire Brigade.

We are, dear Sir,

On behalf of the BRITISH FIRE PREVENTION COMMITTEE,

(*Signed*) EDWIN O. SACHS, *Chairman.*
ELLIS MARSLAND, *Hon. Secretary.*

1 WATERLOO PLACE, S.W.,
February 12, 1904.

* *THE SUGGESTIONS OF FEBRUARY*, 1904.

SECTION 56.

To add: (6) Every metal girder, stanchion, column, or storey post supporting a wall, or a floor, or partition required by this Act to be of fire-resisting material, shall be protected from the action of fire by being encased to the satisfaction of the District Surveyor, in concrete, brickwork, terra-cotta, or metal lathing and plaster or cement not less than 2 inches in thickness.

SECTION 60.

To add: All chases in walls where passing through a floor shall be at every floor level stopped with fire-resisting material of the full thickness of the floor, except so much as is occupied by pipes or other non-flammable contents for which the chase is required.

SECTION 61.

To add: (1) The roof or flat over any shop or other premises used for the purpose of manufacture or trade, projecting beyond the main front flank or rear wall of the building of which it forms part and abutting upon a street, or open space, adjacent to a street, shall be constructed throughout of fire-resisting materials. And no skylight or lantern light shall be placed in front of any window overlooking such roof or flat nearer than 6 feet from such window.

To alter: (2) *In place of* "thirty feet" *substitute* "two storeys," *and after* "parapet" *add* "or a flat roof to any portion."

SECTION 64.

To add: (4) *After* "floor" *on fifth line add* "of the storey," *and after* "situate" *on sixth line add*—Through the height of such storey, and in addition through the height of the storey over, including the thickness of the floor or ceiling joists immediately above same.

To omit: "to the level of the ceiling of the room next above the same."

To add: (6A) When any flue in any building ceases to be used as such. The top and also the chimney opening shall be filled up with brickwork and properly sealed.

To add: (21A) No iron or steel joists or other ironwork shall be placed in any flue or under any hearth to any chimney opening.

To add: (22) *After* "wooden plugs" *add* "or holdfasts or other iron fastening."

To omit: "nor any iron holdfast or other iron fastening nearer than 2 ins. thereto."

To add: (22A) Stoves and chimneypieces in chimney openings must be set solidly in brickwork, or ballast, or broken brick concrete, and no cavities left for the accumulation of soot.

To add: (22B) No wooden boarding or panelling shall be fixed as a lining to walls, partitions, ceilings, or soffits, in any building of the warehouse class, nor in any building used or to be used for the purpose of manufacture or trade, nor in any shop or room used in conjunction therewith.

NEW SECTION TO FOLLOW SECTION 67.

Every lift-shaft, except that placed in the well of a staircase, shall be surrounded by a brick wall at least 9 inches in thickness, and where such lift-shaft is carried up to the topmost storey of any building, the enclosing wall shall be carried up 3 feet above the roof and be terminated with a glass and iron skylight covered with wirework.

(1) Where such lift-shaft does not start from the lowest storey a floor or ceiling of concrete at least 5 inches thick shall be provided.

(2) The opening into the lift-shaft on the several floors shall be closed with fire-resisting doors at least 2 inches in thickness, made to close automatically. Provided that in a lift-shaft, the sectional area of which is under 20 square feet, the enclosing wall may be 4 inches in thickness, built in cement. This section shall not apply to lifts in dwelling-houses occupied or to be occupied by not more than one family.

SECTION 75.

To add after 1st paragraph.

No building of the warehouse class or other buildings or to be used wholly or in part for the purpos manufacture or trade, the floors of which are not structed of fire-resisting materials, shall extend to than 100,000 cubic feet unless divided by party wa such manner that no division thereof extends to than 100,000 cubic feet. Provided that where the th of such building are constructed of fire-resisting ma the building or division may extend to not more 250,000 cubic feet.

No addition shall be made to any existing building exce the aforesaid limits of cubical extent unless the bui be altered to comply with this section; nor shall addition be made to any building nor to any div thereof so the cubical extent of such building or div shall exceed the aforesaid limits.

SECTION 77.

To add:

(3) (*b*) Such opening shall have the floor jambs and h formed of brick or protected iron and be closed by a of wrought iron doors at a distance from each othe the full thickness of the wall. Such doors shall be m of iron at least one half of an inch thick, and not less th one quarter of an inch thick in the panels, and the st and rails at least 6 inches wide and to be either hung hinges or pivots, and fitted close to rebated iron fra and secured by bolts or other fastenings at the top, *midd* and bottom of each style, and to be able to be ope from both sides, or by sliding doors or shutters of simi thickness and construction, fitted close at all edges in grooved and rebated iron frames, and such doors sh be constructed and fitted in all respects to the satisfa tion of the District Surveyor.

To omit:

Sub-section (3) (*b*).

NEW SECTION 77A.

Construction of Warehouse Buildings.

The following provision shall (except with the consent of t council) apply to buildings of the warehouse class a all other buildings used, or to be used, for the purpos of manufacture or trade.

(1) The roofs, flats and gutters of every such building a every turret, dormer, or other erection thereon, shall b

constructed solid of fire-resisting materia
necessary woodwork of doors and frames,
frames, skylights and lantern lights.

(2) All windows in such walls and any skylig
lights lit from such street, court or light-
either fitted entirely with metal frames an
wired glass, or be fitted with fire-resi
capable of being closed and fastened fro

(3) In all such buildings exceeding 10 square
principal staircases shall be constructed c
on supports of fire-resisting materials,
enclosed with walls or partitions of fire-resis
carried up to the roof, or where such stair
extend to the top of the building be cove
floor of fire-resisting materials, and the
passages from such staircases communica
street shall be similarly constructed and en

SECOND SCHEDULE.

To omit: (2) "Granite and other."

To add: (4) *After* "teak" *add* "Jarrah and Karri," *and* timber" *add* "of which a length 6 feet l
2 inches thick will not burn through wit
when flame is applied on one side to 1,8
After "coating" *in last line of first paragr*
less than 2 inches in thickness."

To omit: *the remaining lines of* (4).

To omit: (5) *the word* "slate."

(7) *After* "broken brick" *omit* "stone chippin
"tile terra-cotta breeze or burnt ballast," *a*
"and" *add* "mixed with."

Existi Act.

To add after (7)

In the case of doors and shutters and their fra
Oak, teak, Jarrah and Karri, or other ha
less than 2 inches thick, the frames being
to the walls.

In the case of internal staircases and landings.
Oak, teak, Jarrah and Karri, or other hard
treads, risers, strings and bearers, not less
thick, and the ceilings and soffits being of
crete composed of coke breeze and Portlar
bearers properly protected and encased
2 inches of incombustible and non-conduc

In case of floors.
Brick, tile, terra-cotta or concrete, as descri
less than 5 inches thick in combination with

Nevertheless a fire-resisting floor in an existing building may be constructed with wooden joists in conjunction with concrete, pugging not less than 5 inches in thickness and held in position by a fillet fixed to the side of the joists 2 inches from the bottom of the concrete and the underside of the floor plastered.

In the case of internal walls and partitions enclosing staircases and passages.

Brickwork of the thickness prescribed for cross-walls.

In the case of other partitions.

Terra-cotta, brickwork, concrete, or other fire-resisting material not less than 2½ inches thick.

SUGGESTIONS OF JANUARY, 1905.

THE CLERK,
TO THE LONDON COUNTY COUNCIL,
SPRING GARDENS, S.W.

DEAR SIR,

Re THE LONDON BUILDING ACTS AMENDMENT BILL, 1905.

Views and Suggestions.

Proposed Bill.

In reply to your communication of December 22, 1904, saying that your Council will be pleased to receive an expression of views of the British Fire Prevention Committee with regard to the objects of the Bill, and that any suggestions from this Committee would receive careful consideration, we are desired by our Executive to reply as follows on behalf of the Committee :—

This Committee is fully in sympathy with the objects of the Bill so far as additional protection of life and property from fire are concerned.

Further, the Committee on referring to their communication to you of February 12, 1904, observe that the majority of the suggestions for the Amendment of the London Building Act of 1894, which they then made, are covered in the proposed Bill.

They would, however, venture to point out that according to the reading of the Bill in conjunction with *Section* 75

of the Act of 1904, *Section* 77 *of the Bill* would allow building of enormous cubical contents, as each storey might be c the extent of 250,000 cubic feet, which would mean tha in an ordinary six-floor building the contents would b 1,500,000 cubic feet. Existing Act. S. 64(6A)

The Committee think that this can scarcely have bee the intention of the Council.

The Committee fully comprehend, and are in sympath with the introduction of the principle of allowing horizonta divisions to count in the division of large buildings, an they consider such horizontal divisions to be essential, bu they would suggest that the contents of each horizonta compartment should not exceed 100,000 cubic feet, an that in lieu of the amendment as proposed, the followin should be substituted in this Bill, namely :—

> " Provided that buildings may be divided horizon tally by party structures of fire-resisting materials othe than wood and similarly supported, provided that th compartments so horizontally separated shall not ex ceed 100,000 cubic feet, and any staircase or lift-shaf communicating with any other compartment shall be enclosed with brick walls not less than 9 " thick, and any openings in such staircase walls or lift-shafts shall be closed with doors as required by *Section* 77 *of the Act* 1894."

In *Section* 87 *of the Bill*, we would suggest the word "*porous*" before terra-cotta.

Regarding the use of the word "*porous*" before terra- cotta, experience has everywhere shown that hard or dense terra-cotta is not reliable as a fire-resisting material, and that only *porous* terra-cotta should be used. S. 77(3)

We would again respectfully urge the following addition to *Section* 60 of the present Act :—

> " All chases in walls where passing through a floor should be at every floor level stopped with fire-resisting material of the full thickness of the floor, except so much as is occupied by pipes or other non-flammable contents for which the chase is required."

In respect to *Sections* 96 *and* 97 *of the Bill*, the Committee, whilst fully appreciating the benefit that would be derived, consider that in their present form they will meet with practically unanimous opposition in all directions, which will be fatal to the introduction of the principles involved, and the Committee would suggest that in lieu of the sections as provided, the Council attach specific regu- S 6

Proposed Bill.

lations in form of a Schedule to the Bill dealing with these requirements, and that the administration thereof be left with the District Surveyors.

In respect to the Committee's suggestion regarding the addition to *Section* 64(6*a*) *of the Act*, the Committee would again emphasise the importance of this somewhat small point, and call attention to the fact that this point has already been provided for in the Glasgow Act. The suggestion read as follows :—

> "When any flue in any building ceases to be used as such, the top and also the chimney opening shall be filled up with brickwork and properly sealed."

S. 103. Regarding *Section* 103 *of the Bill*, the Committee would suggest the following addition :—

> "That no wood skirtings be fixed on the face of any flue enclosed with brickwork less than 9" thick."

S. 104. Regarding *Section* 104 *in the Bill*, the Committee do not consider that the lift enclosures specified at 3" are sufficient for other than small lifts running to no greater vertical extent than three floors.

It will be recollected that the Committee proposed that the enclosures should be 9" thick. The Committee suggest that the 3" be limited to lifts not having greater superficial area than 20 ft., and not going through more than three floors, and that for larger lifts, or lifts running a greater height, a 9" wall be required.

S. 78. Regarding *Section* 78 *in the Bill*, the Committee consider that the word "*stone*" should be erased in *Section* 77(3*b*) *of the present Act*.

The Committee would further again emphasise the importance of the suggestions they have made regarding roofs to warehouses, which read as follows :—

> "The roofs, flats and gutters of every *such building* (*i.e.*, building of the warehouse class), and every turret, dormer or other erection thereon, shall be constructed of solid fire-resisting materials, except the necessary woodwork of doors and frames, windows and frames, skylights and lantern lights."

The Committee think that this point should be made an amendment to *Section* 61 *of the Act*.

The Committee also venture to suggest that on the S. 106(I.) important question of opposing window openings, *Section* 106(I.) *of the Bill* is not sufficiently clear for practical purposes.

Regarding the first Schedule in respect to Fire-resisting Materials the Committee venture to respectfully indicate the necessity of more clearly discriminating between materials that are incombustible and useful for constructional purposes, as distinct from materials which are at the same time fire-resisting, and that *Granite*, *Stone* and *Slate*, should be omitted from the Fire-resisting Schedule.

In the *Fire-resisting Schedule of the Bill*, the Committee hold that the following is necessary :—

I.(2) Omit this entirely.

I.(3) To be described as follows : "copper, or iron and steel, *if protected.*"

I.(4) Omit *Slate* and add *porous* before terra-cotta.

I.(6) Add clinkers.

II.(4a) Add the word *porous* before terra-cotta.

II. (4b) Add "if the under side is protected by plaster."

II. (6) Add *porous* before terra-cotta ; omit from the word *thick* onwards, and replace by "*in sections not exceeding 200 feet super.*"

II. (7) Put *hard* before the word "*metal*," for if the clause stands as drafted, lead lights would be admissible.

As to special observations on *Clause II.* (6) *of this Schedule* the Committee hold that the application of any other metal than 1" hoop iron, or ¼" wire in 3" partitions is entirely inadvisable and dangerous, and that the sections of partitions exceeding 200 feet super require proper structural supports, or iron supports protected as indicated in the Bill.

The Committee repeat that, regarding the use of the word "*porous*" in the Schedule before terra-cotta, experience has shown that hard or dense terra-cotta is not reliable as a fire-resisting material.

The Committee, in putting forward these suggestions, trust that it may be possible during the progress of the Bill through Parliament, to make the above amendments in the direction indicated.

We are, dear Sir,

For the BRITISH FIRE PREVENTION COMMITTEE,

(*Signed*) EDWIN O. SACHS, *Chairman.*

(*Signed*) ELLIS MARSLAND, *Gen. Hon. Secretary.*

1 WATERLOO PLACE, S.W.,
January 27, 1905.

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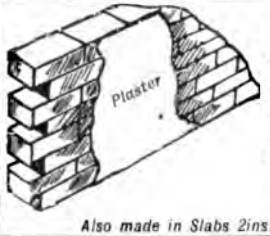

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